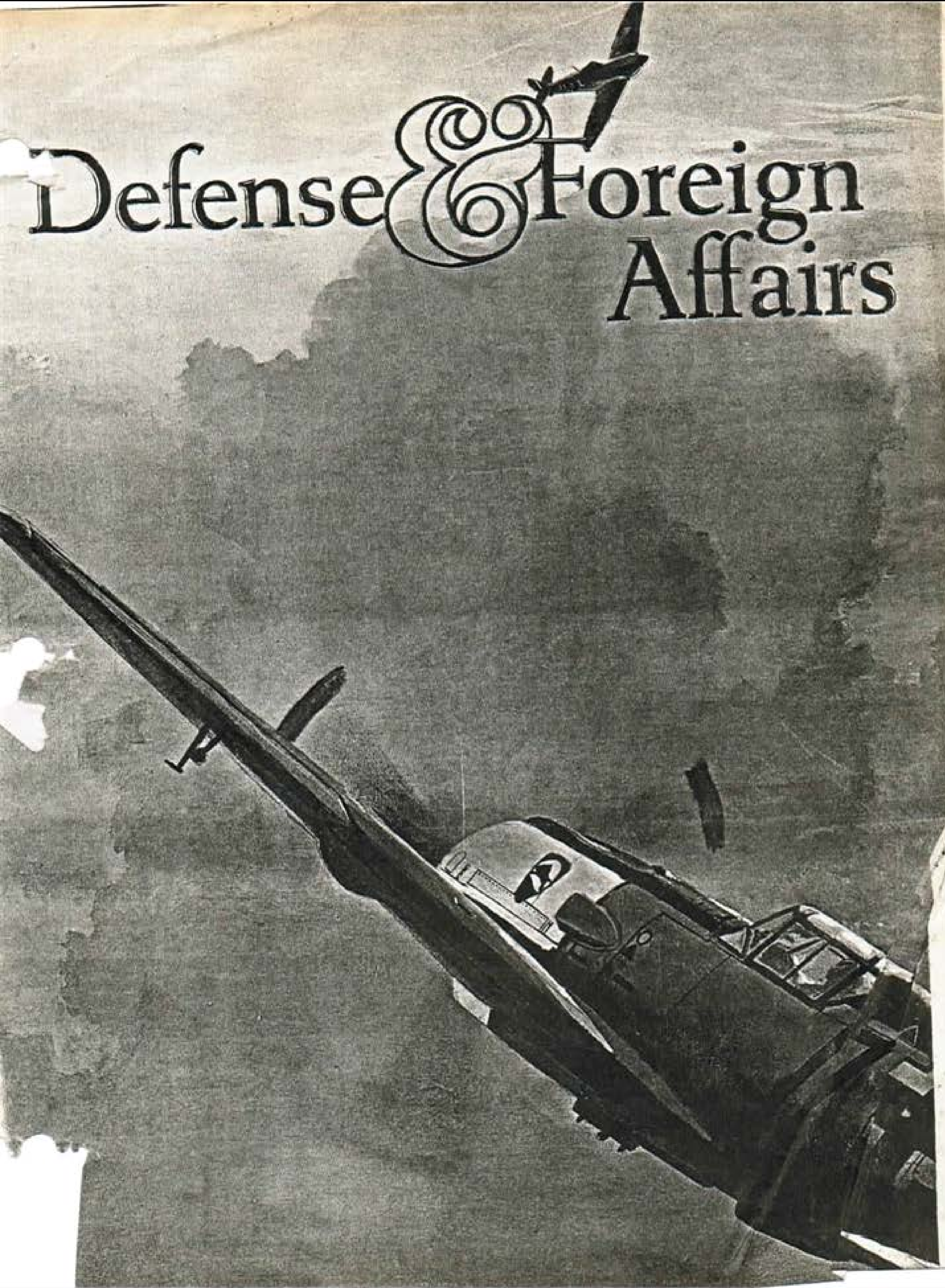
Defense & Foreign Affairs



Defense & Foreign Affairs

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Subscription Rates
US$70 per annum in North America and Mexico. US$87 (airspeeded) elsewhere.

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PUBLISHER'S NOTES Vol.XII, No.8

ANYONE WHO GETS BORED in this business is obviously missing the point. Nothing could place one at the centre of more excitement, more involvement, more knowledge. Strategic affairs and defense issues get to the heart of survival, and the key to that survival is information and understanding. Dr Possony's major report — The Tesla Connection — illustrates the point. It opens an entirely new dimension on the question of global strategic technology.

Obviously our Editor, David Harvey, is still not bored with the whole question of things strategic after almost a decade with "Defense & Foreign Affairs". From August 1 he leaves his present post to take up a new position with us — as Editor-at-Large — which allows him greater scope to pursue his research and journalistic forays which have served us well in the past. But the move also allows him scope to pursue a very much related and exciting new venture of his own: a new newsletter entitled International High Technology Report, which will track key developments in emerging technology around the world. With the giddy compounding of the rate of growth of scientific knowledge, such a venture seems eminently sensible. And something which allows every defense, government and industry type to keep up with the things which will affect our collective future. We wish him well in this new challenge, and we're delighted to maintain a strong link with him in our pages in the future.

Senior Editors Dr Michael Collins Dunn and Jacquelyn Porth also move to more new posts this month, as Managing Editor and Deputy Editor respectively, as our operations grow.

And we're bringing in a new feature with this edition, one which will complement the Psychological Strategy and Intelligence reports we carry regularly. The new column — Special Operations Report — will appear every month under the overall command of a US special ops type, Ross Kelly. This will be a unique regular report, and will serve not only to introduce the scope of Special Operations in the 1980s (as this edition does), but it will analyze every major special ops unit in the world during the course of the next couple of years. It's a major task, but one which captures an immensely significant topic.

EDITOR'S NOTES

ANY EDITOR CONFRONTED with the draft of an article like "The Tesla Connection" on page 12, has to pause for careful consideration. The whole subject of directed energy weapons is extremely treacherous. Pure theories — hard to penetrate independently — are often touted as accepted fact, leading to some incredible claims by their proponents.

However, if it's true that a man lives by his reputation, the risk is lessened when Dr Stefan T. Possony, our Associate Editor is the report's author. Possony's methodical approach to science and technology over the years has won him many plaudits — and high level advisory posts in the US Government. But even for him the story of Tesla waves was almost too much at first. Only after months of checking, and many talks with T.E. Bearden, the only US scientist taking Tesla's effects seriously today, did he decide this was something which deserved to see the light of day. Possony, a veteran of many bureaucratic wars, is no dupe: "I'm aware of several reasons why such weapons may not work, but I don't need expressions of doubt, especially from those who have not studied the problem," he says. "But if there is evidence that Tesla weapons can't work, we want to hear it." A challenge to the scientific censors who have consigned discussion of the subject to the deep freeze.

What he has produced is a fascinating study of a dimension in physics which could have a giant effect on strategic planning. We stress the "could". Hard evidence is very slim. But what seems indisputable is that the basis of knowledge has been mastered, both in the US and the USSR. Could somebody have dismissed nuclear weapons in, say, 1930? Very likely. But that would have been to deny a huge body of scientific data which said: "Yes, one day, maybe." Strategists HAVE to like futuristic mystery stories. They also have to find them, as Possony has.

POSSONY

Defense & Foreign Affairs

The Tesla Connection

Nikola Tesla, the ''founder'' of alternating current and directed energy is a non-person today, discarded by modern scientific orthodoxy. But what he had to say may have taken on a new relevance, with profound implications for the basis of strategic reasoning.

Associate Editor Dr Stefan T. Possony investigates.

For good reasons, the US has long cleaved to a defensive military strategy. Concurrently, it should have decided to adopt sub-strategies to ensure the success of the defense, in the sense that hostile offense would be foreclosed. This has not happened: no systematic strategy to forestall surprise and thereby prevent aggression has been developed. The Strategic Defense Initiative (SDI) constitutes the first step toward a rational peace preservation strategy. Hopefully, second and third steps will follow. ¶ There are three major types of surprise which must be avoided. They are: ***Firstly***, the sudden transformation of friends into foes; ***Secondly***, operational surprise, such as an unexpected geographical center of attack, unexpected timing, and unexpected numbers and reserves; and ***Thirdly***, technological surprise such as unexpected weapons and extraordinary performance. ¶ The US is generally well informed about the politics of its major allies, but it tends to be confused about the distribution of friendly and hostile groups both in the allied and in enemy countries. Originally the US was not much worried about operational surprise, but when the USSR moved into space, the US followed suit and established warning systems and surveillance from orbit. Though space surveillance is not foolproof — no system is — the hazard of operational surprise has been managed efficiently. Consequently, the would-be attacker must compensate for his presumed operational inability to strike like a bolt from the blue. ¶ The US has been holding the technological lead for a long time, during which it acquired major advantages in nucleonics, astronautics, electronics and computers. Given this leverage, the danger of technological surprise for the US has been downgraded. ¶ This low assessment of technological ambush is visibly reflected in the SDI. A leisurely timetable is being established, despite the fact that the Soviets began their charged particle beam program some five years before the US got wind of it. This Soviet effort ran for another five years before the US began to do some work on its own account on particle beams. Thus there exists one major technology in which the Soviets, it appears, may have gained a valuable lead. ►

Defense in an N-Dimensional World

True, particle beams are just one of the several technologies through which the defense initiative can be implemented. But is the question properly posed when charged particle beams are conceived as merely one of many technologies? If this were the case, might a lead in this area not be decisive by itself, if only because it would prime virtually all other technologies?

US Air Force Intelligence discovered the Soviet particle beam program. This discovery came as a total surprise, both to the intelligence and military-scientific "communities", and it was discounted, ridiculed and disbelieved for years. However, after this new "reality" was accepted, reaction was slow and evaluations were reductionist; to a point where the advance into sub-atomic realms was treated as a normal routine: just one little step forward at a time. *That major and entirely unprecedented "potentialities" may be involved in the sub-atomic dimension was not recognized, even though such a perspective is implied or explicitly discussed in modern textbooks.*

Numerous physicists have stated that the four dimensions we now know as part of "space-time" are not sufficient to comprehend nature; more are needed and are, presumably, yet to be discovered. If such recognition were to occur in the canons of military science, there is no public recognition of the fact.

Technological Surprise

Given modern intelligence systems, how might technological surprise occur? Let us assume two protagonists "share" scientific information through the processes of research and exchange. In this case, one side might fail to develop one or the other opportunities either because of an oversight or because capabilities of exploitation are lacking.

However, there may be the more profound reason that one side rejects new information or misinterprets data because those do not conform with principles or beliefs regarded as correct or unchallengeable. Once upon a time prominent American scientists denied that powered flight was feasible.

Sometimes scientists "forget" disturbing facts and accept uncritically what they learned in schools or read in dictionaries. They don't always live up to their professed ethos. Example: the velocity of light is a "constant", and as such basic to much of physics. Yet the actual figure of 300,000 kilometers per second is an average of numerous different measurements; strangely enough, this average has not remained unchanged. Worse, Soviet scientists discovered that light is faster in a vacuum on earth than in space remote from planetary masses. American scientists are reported not to believe this. Since "it can't be so," this discovery is simply ignored.

A very important effect (which will be discussed later) was discovered by one well-known US physicist, a protege of Einstein, together with an Israeli graduate student. In 1959 the information was published in *The Physical Review*, one of the leading "refereed" physics organs. Two months later the paper was published as a lead article.

The asserted effect was verified experimentally by a third physicist in 1960.

This background suggests that the findings of this paper should be accepted as valid, and the information would normally be so handled. Yet the effect which was disclosed in 1959 remained largely unknown, and reportedly was, and still is, being totally ignored in military technology research. Nobel prize laureate Richard P. Feynman, in specific reference to the effect in question, ascribed the neglect of 25 years to "prejudices of what is and is not significant".

Directed energy was anticipated — or rather invented — by Nikola Tesla, working more than 80 years ago. As the inventor of the alternating current (AC), he was once regarded as the world's outstanding theoretician and practitioner of electromagnetism. He refused the Nobel prize, which had been offered jointly to both him and Edison. Tesla viewed the methods of selecting laureates as incompetent and dishonest.

Problems of primacy pitted him against Marconi and Edison, and financial problems turned Tesla into a black sheep: alternating current was threatening huge investments in direct current. His experiments on "free" electric energy showed him up as crazy among conventional physicists

Tesla was the foremost victim among American scientists. His work is ignored in textbooks and curricula generally. The investigations which he started were soon dropped. The resulting damage to the US was substantial and durable.

The American scientific body is covered, in fact, with numerous "Tesla tumors". To be sure, treatment by means of downgrading, silencing and forgetting is not a specifically American speciality. It is an inborn affliction of all scientific communities, and it is visible in the history of Nobel prizes. Fortunately, after a a lapse of time, the trouble tends to be self-correcting; or so we hope.

However, danger tends to be high if science and research are undertaken for the Armed Forces under monopolistic direction, and with dogmatic and arrogant scientific advisory boards sticking to biases. As a result, major technologies may be blotted out, and unexpected opportunities ignored or denied. A catastrophe can ensue if the opponent does not suffer from the identical bias, but develops a technology which exploits the opponent's "bias".

For more than 15 years strange "phenomena" have been observed in many parts of the world, whose nature has not yet been deciphered. (UFOs and "flying saucers" are not part of this scene.) The "phenomena" include flashes, fireballs, aerial blasters at high altitudes, loud booms, brightening skies, arcs in the sky, expanding globes of light, giant underwater sounds, possibly anomalous earthquakes, and abnormal weather patterns.

Some of the phenomena have been interesting, to say the least: radar "invisibility" was suggested, an alert that stealth capability may already exist, and long-distance communications of a new sort were received. The strength of the signals was stunning. Dubbed "woodpeckers" by US intelligence, the sounds were explained by the very powerful over-the-horizon *Henhouse* radars which are deployed in the Western Ukraine. Some analysts were wondering whether the Soviets were, at that point, interested in upgrading radars to actual weapons. Since *Henhouse* is merely a very modern radar, this seems to be an artificial speculation at best. Also, it is not known that the signals actually originated in those or any radars. After many years, the woodpeckers remain mysterious.

The "discovery" by *Vela* satellites of two seeming nuclear tests which were falsely attributed to the Republic of South Africa was another episode in the series

A "Tesla" weapon system represents a highly advanced form of directed energy. Yet many of the problems which bedevil particle beams on their passage through the atmosphere will not be significant in the new technology.

of inexplicable phenomena.

An impressive "phenomenon" happened on April 9, 1984, when a mushroom cloud, with the astounding diameter of 150 miles, rose to an altitude of 60,000 feet within two minutes. This occurred south of the Kuriles, 200 miles from Tokyo and 350 miles from a Soviet missile testing ground. A nuclear explosion? Five Boeing 747s flew through and near the cloud, and found no radioactivity. The plume was neither nuclear or volcanic. Instead, the cloud was *much colder* than the ambient air. Satellite photography has recorded 78 similar mushrooms since 1974, many of those in the Arctic.

Late in 1975 infra-red sensors on US satellites were temporarily disabled in four incidents. In one case a sensor was blinded for four hours. This incident demonstrated not only that an operation was mounted with effective equipment (not with blueprints), and with outstanding accuracy.

It also indicated that a power source was available for sustained attack against satellites. Nothing is known about the equipment and the power supply, and neither the accuracy nor the duration of the weapon effect — if that is an accurate way of describing it — are understood, nine years after the occurrence. The incident is subjected to "protracted silent treatment". Yet the event may indicate that US space warning systems are becoming vulnerable.

The mysterious phenomena have in common that they are not "natural" but technical and deliberate. They are electrical and electromagnetic, probably are caused by beams, and they have multiple military implications. They all require enormous energies whose nature, versatility, range and origin remain enigmatic.

The press has reported on several of the unusual observations. Yet little has been done to confirm geographic origins, or to identify the equipment which may be responsible for such phenomena.

One of the weapons identified at Sary Shagan may, indeed, have been a Tesla-type weapon. However evidence for this seems to have attracted very little attention. The official reaction to all the evidence that a beam-weapon program of some sort is well underway in the USSR remains marked by lethargy and disinterest. "We don't know, and we don't know anybody who would know." This line needs to be rewritten: "We won't ask those scientists of whom their 'mainstream' colleagues disapprove." For as long as this attitude persists, a rather sudden and far-reaching surprise operation should not be astounding.

BOHM-AHARONOV EFFECT

WITH THIS background, it's time to look more precisely at the "effect" which science orthodoxy has deemed inadmissable as evidence, unmentionable as a possible practical weapon.

The effect — the Bohm-Aharonov effect — was discovered by David Bohm and Y. Aharonov in 1959, and verified in 1960 by R.G. Chambers. It is a difficult concept to grasp immediately, but, in essence, it shows that in the absence of electrical and magnetic fields, the "potentials" (a potential has been likened by one scientist to a "wave force" passing through water, invisible in physical terms but capable of enormous energy in and of itself) still exist and cause real effects in field-free regions. Bohm's summary of the basic paper described "the significance of electromagnetic potentials in quantum theory" this way:

"Contrary to the conclusions of classical mechanics, there exist effects of potentials on charged particles, even in the regions where all the fields (and therefore the forces on the particles) vanish."

In the discussion,[1] the following statements appear:

"In quantum mechanics, the fundamental physical entities are the potentials. The fields are derived from them by differentiations,"and;

"The potentials are richer in properties than the fields," and;

"The potentials must, in certain cases, be considered as physically effective, even when there are no fields acting on the charged particles," and;

"The classical notion that the potentials cannot have any meaning, except insofar as they are used mathematically to calculate the fields, . . . cannot be maintained for the general case."

These statements of 1959 were enlarged in 1980. A summary of the new version reads as follows :[2]

"Empty space . . . is not empty at all; it's full, an immense sea of energy on top of which matter as we know it is only a 'small quantized wavelike excitation . . . rather like a tiny ripple'."

"The entire universe of matter . . . is to be treated as a comparatively small pattern of excitation on the energy sea."

Bohm is a physicist of world reputation, even though some of his work is disputed. He co-authored another important paper with Nobel Laureate Louis de Broglie, who developed the wave nature of electrons, and who is considered one of the champions of modern physics. Much more could be said about Bohm but, briefly, this physicist cannot be ignored. For that matter, Tesla, Bohm's predecessor two generations removed, must be rescued from oblivion.

At this juncture, however, there seems to be a glimmering awareness, spotty as it is, that the "effect" he identified is beginning to get more attention. During the 1984 Annual Meeting for the Advancement of Science, for instance, there were three references to it, one in connection with neutrons, and another in an astrophysical discussion. In the third case a plasma specialist, during a panel on security, was asked: "What is the military significance of the Bohm-Aharanov effect?" His extremely speedy and testy answer: "None." Whatever the pertinence of the answer, the man was familiar with the problem, and was distinctly uneasy about the question.

Since the Bohm-Aharanov effect disproves the tradition which regards electrostatic and magnetostatic potentials as being of negligible importance, and which then treats them as purely mathematical considerations, it follows that these potentials are real entities. Hence the potentials can "directly affect and control charged particle systems even in a region where all the fields and hence the forces on the particles have vanished," to quote T.E. Bearden, an expert on the subject who has written the only extant analysis in Western literature of the military implications of this effect.[1]

Creation and annihilation of quanta mark the observable passage of an object through time. Fundamentally, the quantum change is controlled by the invisible substructure of matter — subquantal ("virtual") actions and interactions, if you will.

The First Order of Reality, which is observable, emerges from the vector interactions of electromagnetic energy with matter. There is a more fundamental Second Order of Reality which is "unobservable". This reality consists of virtual (subquantal) vectors and conditions. This is the Second order Tesla discovered (using a different terminology).

The notion that a vaccum is *not* total emptiness, but denotes merely the absence of mass is no longer in serious dispute. A vacuum is a charge, more exactly a "charge-flux", without mass. Accordingly, the physics of today regard all observable forces to be generated by virtual particle reactions. The well-known British physicist Paul Davies said that modern theories of the vacuum reveal that empty space is "seething with activity."

Bearden explains that such activity in and through a point constitutes a "potential" at that point, in other words a flurry of forces caused by the crossing of two streams of virtual matter. Put another way, there are spaces without matter, or vacua, but there are no spaces without potentials.

Particle physicists believe that physical reality consists of "internested virtual levels" — clutches of these second level particles — of ever finer structure. Moreover, these unobservable structures of "spinning particles" carry, or are, massless charge-fluxes in constant acceleration. In this context, Einstein, who transformed the three-dimensional world into a four-dimensional world, has been "overtaken" by modern physicists who now propose models of eight, 11, 32, and still more dimensions.

While particles provide the substructure of what may be called "visible" reality, they can also occupy the invisible reality (although in invisible form); they can co-exist with "matter" as it's understood. This "hidden realm" is known as the "Dirac Sea", after P.A.M. Dirac, one of the founders of quantum theory.

Bearden associates each virtual level with what he terms a "hyperspace", a concept adapted from J.A.Wheeler, an expert on space-time physics, while still another concept is that of the "neutrino sea", which has been promoted by astrophysicists. Quite clearly bewilderment exceeds the levels it did when electricity was discovered.

Tesla discovered that waves and beams of pure potential, that is waves and beams without observable electric and magnetic fields, can quite easily be made and utiliz-

Continued on Page 27

Tesla Connection

Continued from Page 15.

ed. Since this "wave" appears to be his fundamental, not to say repressed secret, the name "Tesla Reality" for the Second Order of Reality might be most fitting.

There are differences between these various concepts, but they all seem to agree that the invisible particle substructure is of the utmost importance and cannot, therefore, be consigned to being "just" absolute zero. On the contrary, this substructure is, or contains, huge magnitudes of energy pitted against one another, and it influences or determines the force vectors in the observable reality.

All observable forces arise in, on, and of the actual sub-structure of accelerating particles. All such particles are charged both *internally* and *externally*, ie: they are dynamic assemblages of smaller charged particles. Moreover, they are constantly changing from one kind of particle into another, forming a sort of "charged cloud".

This vast complex has so far only been suggested. At present, high energy physics remains mainly concerned with subatomic particles, and the inter-relationships between the particles and the atomic and molecular worlds are as yet largely unexplored. To recapitulate: the space vacuum, as we know it, is the sum total of all "virtual things". It is in constant flux, and hence it is totally charged. But it is still being assigned a hypothetical zero charge.

In contrast, and on the basis of up-to-date interpretations, Bearden has estimated that the potential of the space vacuum may run up to as much as 200-million volts at a given point in a space with more than four dimensions.

So we have one interpretation assuming no charge, another saying the charge is of incalculable magnitude. What a show of confusion!

Evidently, military technologists can no longer, or should not, ignore the physical substructure in their strategic investigations and weapon equipment designs.

So, what might be done with this potential?

Given the Second Reality, "beams of pure potential without observable vector force fields may be deliberately produced and intersected at a distance, to cause observable — and powerful — effects in the interference zone," according to Bearden.

This is where the physics gets a bit difficult, but to achieve military effects, two of these Tesla waves — non-Hertzian longitudinal waves of electronic potential — may be launched through the vacuum, achieving their "force" through "interference" where they cross in the target area. They can be targeted with great precision.

Each wave is composed of two or more interlocked waves of identical frequency, with cancellation of their opposing magnetic and electric fields, so that the externally observable vector fields sum to zero. The two crossing waves are related to four or more virtual waves in the sub-structure. The working energy is not "transported" from the operational base through space to the interference zone but instead is directed to "arise" there — from the intersecting Tesla waves. *That is, instead of transmitting energy, the input energy is transformed into potentials which are interfered at a distance, modifying and producing the energy again in the interference zone.*

In the interference zone this energy can be released in many ways, in the form of pulses or high temperature explosions. Alternatively, energy can be withdrawn from the interference zone, producing a *cold* explosion. Precision is needed for the locating of the interference zone, but good accuracy can be achieved through narrow beams and a substantial input of energy resulting in high energy density.

The energy needed to do military work in the target area is pumped into the two waves at their launch base. The working energy at the distant zone will be approximately as large as the injected energy, with only minor leakages and imperfections anticipated on the way.

Tesla two-wave interference weapons may be substantially cheaper than current and projected systems. Such weapons can be used for non-lethal as well as lethal purposes, as they possess both defensive and offensive uses.

A "Tesla weapon system" represents a highly advanced form of directed energy. Yet many of the problems which bedevil particle beams on their passage through the atmosphere will not be significant in the new technology. They promise to have a uniquely broad spectrum of military and industrial relevance.

Among "ideal" applications are anti-avionics jamming, under-water communications and the location of submarines, strategic defense and warfare, operations in space, and possible use in large-scale and weather modification.

Interferometers will be the principal element of any such weapon, and may be the core of some of the Soviet devices and weapons which have been examined. The weapons will need explosive power generators (a branch of technology in which they are highly proficient), special power units to produce energy from vacuums, translators to create and alternate waves, Fourier transformation computers and transmitters, and aiming-pointing instruments. But, if the Second Order of Reality is correctly recognized and can be entered as predicted, the military gear required may be neither large or complicated. While this might enhance the present danger, it might also facilitate the task of quickly countering the unexpected threat.

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What's the message?

First, the world in which we live has undergone a major transformation. We have learned to live in two orders of existence, the Einstein and Tesla realities. The first is known as space-time, and the second as the sub-structure of matter and vacua. Space-time is four-dimensional, and the two realities together are at least six-dimensional.

The transformation has come as a major surprise, but the surprise is behind us as a fact and and as an occurrence. Comprehension, however, is still ahead of us.

Second, the USSR knows about the six or n-dimensional world, and it seems to possess various interferometric equipments usable for directed energy operations. This means a strategic surprise may be in the making, possibly a decisive surprise.

Third, the exploitation of unilateral surprise is based on superior knowledge and equipment. This can take different forms ranging from psycho-politically induced panics to military disasters. Actual choices for the Soviets, if any, depend on their concrete capabilities. And fourth, a prudent reader will understand that the discovery of a danger must be supplemented by its measurement. This task must be performed without delay by knowledgeable, wise — and young — experts in intelligence, science and technology, and military planning.

Fifth, it seems reasonable that Tesla weapons must be studied completely, and the impact of the novelty on existing and emerging armaments assessed.

Neither panic, nor flight from reality will help, and the typical advisers who belittle or deny innovations should not be expected to be useful. If the danger is real, Tesla weapons will mean a military transformation whose magnitude will exceed that of the nuclear and electronic space revolutions. But the effect of those weapons will depend on the energy which is fed into them. Furthermore, surmising that tests have been going on, those weapons must be produced and deployed, and crews must be trained to operate them. Evey surprise has its limits.

The task, therefore, is not insoluble. On the contrary, an extraordinary chance to discover entirely unprecedented opportunities for security may be arising. The Pentagon includes specialists who are knowledgeable about the demise of the old vacuum and the emergence of novel dimensions. But they don't believe the "political atmosphere" is receptive to such novelties. No realist should expect bureaucracies to champion technological upheavals, let alone total transformations. ☆

FOOTNOTES:

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1. The Physical Review, Second Series, Vol.115, No.3, August 1, 1959, pp.483 and 490.

2. For a recent discussion of Bohm and his work, see John Briggs and F. David Peat, Looking Glass Universe, the Emerging Science of Wholeness, New York, Simon & Schuster Cornerstone Library, 1984, chapter 2, eg p.140. See also p.132: "In one cubic centimeter of empty space the amount of energy is much greater than the total amount of energy of all the matter in the known universe."

3. Those who wish to study the scientific basis of this story, to understand various concepts of weaponry, and to familiarize themselves with the mysterious phenomenon should consult the writings by T.E. Bearden, published by Tesla Book Company (1580, Magnolia Ave, Millbrae, CA 94030). Bearden, a weapons analyst and nuclear engineer, is at present developing an Artificial Intelligence (AI) "expert system" for command and control. His previous work dealt with technological requirements of Nike-Ajax, Nike-Hercules, Hawk, and Patriot missiles, and high energy laser weapons. He holds advanced degrees in mathematics and nuclear sciences. A retired Lieutenant Colonel in the US Army, he graduated from several US Army artillery and missile schools, and from the US Army Command and General Staff College.

THE MONEYCHANGER

Formerly Gold & Silver Update **Volume IV, No. 7, August, 1984**

Information deadline July 23, 1984

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TESLA PHYSICS, FREE ENERGY & SOVIET WEAPONRY:

AN INTERVIEW WITH COL. THOMAS E. BEARDEN

In our April issue we promised you more on so-called free energy devices. Our investigations led us to further diveries, most notably the startling assertion that the Soviet Union has advanced weaponry developed from Tesla physics. The most often quoted source of these allegations, perhaps the most knowledgeable Western expert on Soviet Tesla weaponry, is Col. Thomas E. Bearden of Huntsville, Alabama. Not coincidentally, Col. Bearden is also in the forefront of the application of Tesla physics to energy production. So in June we packed up and drove Huntsville to interview Col. Bearden, accompanied by that gentleman attorney, monetary realist, and student of the unusual, Larry Becraft.

When you are dealing with a wide-ranging mind such as Col. Bearden's, the conversation quickly gets out of hand. The economic, military, and industrial implications of Tesla physics are so broad, however, that I think certain digressions are justified. The opinions and assertions made are those of Col. Bearden, not necessarily those of **The Moneychanger**. *However strange our discussions may seem, we hope it will stimulate you to further research of your own.*

Moneychanger Col. Bearden, tell us a little about yourself.

Bearden I retired from the Army as a lieutenant-colonel, and now work for a large aero-space firm. I do fairly ordinary things. Right now I am applying some expert system technology for artificial intelligence and weapons analysis. Very ordinary things.

MCFrom what we've read you"ve somehow become the most quoted expert on Soviet Tesla weapons.

3earden Well, probably that's because I was one of the very few people that had guts enough to go out and say that they had developed such weaponry. Now certainly Andriya Puharich for some time has been talking about the development of Tesla technology, and Dr. Beck has been investigating the effects of electro-magnetic fields of all kinds on biological systems and human beings. These are all Americans. But what I really started out to do was just to look at paranormal phenomena, unusual phenomena. Everything that goes bump and bang, just unexplained things across the board, without any preconceptions. When you do that, it very rapidly becomes obvious that these phenomena are not working by the laws of nature as we teach them today, and that shouldn't surprise us. We've only had a modern science about 300 years.

MC Does "unexplained phenomena" include psychokenesis (moving things with the mind), poltergeists, flying saucers, parapsychology, miracle healings?

Bearden Well, yes, but we haven't studied all of those intensely. It's interesting that most of those are fairly simply studied. There are, for example, over 1200 sites in the US alone in which on any reasonably good night with good weather you can see what is called a "will o'the wisp" or what is really earth-stress lights. Here are controlled balls of electro-magnetic energy that come out and bubble around and they're not glowing balls of gas. You can photograph them, balls of light bobbing around at below tree level or at treetop level. Right here in Athens [Alabama] we have a site where two young lads did several years study with lots of photos, and it's quite easy to "prove" conclusively that here is a natural phenomenon that anyone can observe. Meanwhile in physics many people are looking for lightning control or electro-magnetic energy in ball form, and trying to make it with huge voltage blasts and here it is, gently, all around them. But they don't go out of the ivory tower to look

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at it. In their minds they have already labeled it folklore, but they've never gone out to see. There have been several very good studies done on these lights, with all sorts of equipment, particuliarly the studies by Vestigia. Some of these lights do interact with human thought.

Now there is another interesting thing about science. It's quite fashionable today for a hardcore scientist to take an official position that we are essentially robots. Our minds are supposed to be really nothing but the product of electrical charges in the nerve cells and brain.

MC B.F. Skinner and his group.

Bearden Well, even worse than Skinner. they really contend that the human being is not really a living thing, just a robot. I was once guilty of telling one such learned professor that if he believed that he was a robot I had no further interest in talking to him because I didn't talk to robots. I talked to human beings.

Tesla was quite right, and all the textbooks in the western world are quite wrong.

MC Not much room for God in that system, is there?

Bearden Not much room for God and not much room for human beings. What upsets me about our Western science is the prevailing attitude of trying to suppress anyone who wishes to study anomalies. They attempt to impress upon a graduate student that there are no anomalies, that everything is already completely explained.

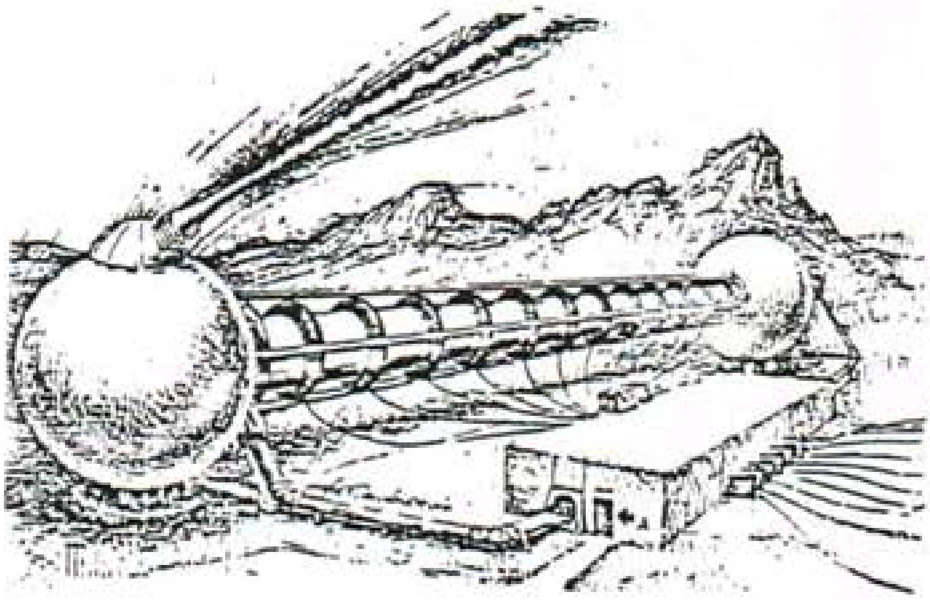
MC That sounds like a good deal of presumption.

Bearden Of course it is. As I said, we've only had a modern science for 300 years, and we're very primitive yet. If there were a million year old culture, we wouldn't even recognize the science they might have. As one great science fiction writers states, we would simply see sheer magic. When the foundations of our present science, let's take electro-magnetics, were put together, say 100+ years ago, they didn't know anything about an electron. They didn't have the electron theory when they put together the basis of electromagnetics, they just looked at a thin fluid and developed the electro-magnetic equations, which are simply fluid equations, hydrodynamic equations. Later we discovered electrons and fitted them into the theory.

One simple example proves that all the electro-magnetic textbooks are totally wrong at base level. I'm not saying they're not useful, just that the fundamental concepts are wrong. Since Hertz we have said that electromagnetic waves are transverse waves. Tesla pointed out that this was not true at all. In a wire, we visualize the electron as being relative free to move. They are and they aren't. They are free at least to move sideways to the skin of the wire. They cannot flow very much down the wire like water running through a pipe. The [electromagnetic] signal runs down the wire with a speed almost the speed of light, but the electrons only drift along with the velocity that might normally be on the order of so many meters per second, not at all the 300 million meters per second lightspeed. So with respect to the signal running down the wire, that electron is almost frozen. It hardly moves down the wire at all. It moves with a "drift" velocity. The electrons drift gradually along the wire, but the signal is long since gone. Now that little free electron is spinning, which means it's a little gyro, it's restrained along its line of movement. That means it can't move away from a disturbing force, because any disturbing force that pushes on a restrained gyro cause the gyro to *precess*, that is, to turn at right angles to the disturbing force. So if the model of the electron as a little spinning gyro is true, the electron has to move sideways to a disturbing force. This means that if I detect an electron movement, the disturbing force was at right angles to the way the electron moved. That's how we always detect the electron moving, sideways, laterally, transverse. Inescapably this means that the disturbing force was longitudinal. It never was transverse in the vacuum at all. The point is, you aren't measuring what's in the vacuum, you measure what the electrons are doing in your probe. They are Hertzian waves, they do make such waves, but the wave in the vacuum has never been a Hertzian wave, it has always been a longitudinal wave. Tesla was quite right, all the textbooks in the entire western world are quite wrong in that respect. The electrical signal in a vacuum vibrates like a sound wave by rarefaction and compression. Tesla called it an electrical sound wave, and that's what's in the vacuum.

MC I thought that an electrical current was a flow of electrons. You are saying that the electrons are in there, but their flow is not what the electricity is.

figure 3. ARTIST'S CONCEPT OF A LARGE SCALAR INTERFEROMETER TRANSMITTER.



Bearden The signal that flows down the wire is not the flow of electrons. The electrons move in the field that makes the signal. Electro-static scalar potential is what moves down the wire and that moves essentially at the speed of light. We measure the electrons moving sideways to that force.

MC So it's a misnomer to say that an electrical current is 50 hertz or 60 hertz. The current is not. The movement of the electrons is.

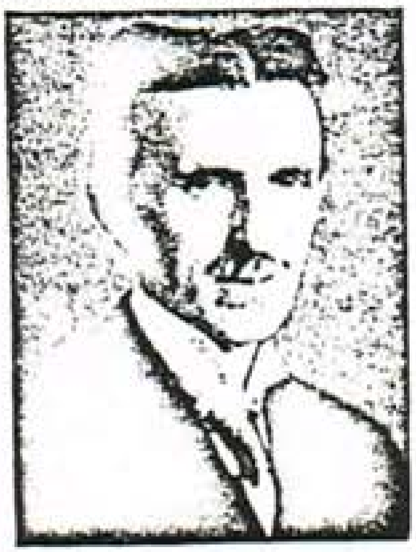
Bearden There are two currents in the wire. There is this current made of the electrons and it is moving along in meters per second, not nearly the speed of light; it is the mass current. Now the massless charge, what we call the electrostatic scalar potential, FEE field, does move down the wire at almost the speed of light. Just as this conception is all messed up, so are the foundations of the force idea of Far- and his "force fields", which don't really exist in vacuum.

MC What you're saying is that there is a system of electrical physics that works to predict how electricity will operate under certain circumstances, but it is based on a false definition. That it speaks correctly or comes to the correct conclusions does not mean that it arrived at those conclusions correctly.

Bearden What has happened is that at each step they did the best they knew at the state of the art, but nobody has taken the next 100 years of knowledge and the changing ideas about the nature of physical reality and gone back to those foundations and said, Which ones of these now need changing because they don't match. We need a scrub job. Tesla saw this, he knew it to begin with. Tesla couldn't understand why everyone was taking off down the wrong road.

MC How does all this tie in with free energy?

Bearden If I want to build a free energy motor, what'I want is lots of energy that won't cost me very much. What I have to do is set up a river, a natural situation where nature is putting in the energy flow. Here is this stuff here, this dense flux all in a vacuum, very dense. It forms a stress, tremendous energy folded against itself. I must set up a river in this stress, and a way to collect that and turn it into radiation which will give me electromagnetic energy or movement of particles which will give me ordinary electricity. But really what I have to do is set up this virtual river, and that is not much different from sticking a paddlewheel into an ordinary er, its just a more subtle river. A paddlewheel is really a e energy device. It doesn't cost you anything. Somebody else runs the river. As long as the paddle wheel isn't broken and that river runs, you can sit there and extract energy from now on, forever. There are subtle energies that can be set up in the electromagnetic realm and you can tap them from now to infinity.



NICOLA TESLA

MC But how do you go about tapping them?

Bearden Nature has been most kind. This little electron, this little charged particle, is a crazy kind of pump, and a vacuum sump at the same time. It's blowing out these virtual particles, flux and it's sucking them in at the same time at an awful ate. Nature keeps that thing going forever, you don't have o do anything. We live in a universe of magic pumps, called charged particles. Everything is charged, it's built that way. These scalar waves are coming from everywhere: the sun, stars, are pumping out tremendous scalar waves, enormous amounts of energy far beyond what we ever thought of.

MC This is the "sea of energy", the ether, that Tesla physics talks about.

Bearden Of course. In one cubic centimeter there is enormous energy, enough to build this whole universe.

When we look through these [problems with the existing accepted] electromagnetics I am struck by a most remarkable thing. The present electro-magnetic theory we are using, Hertzian waves and so forth, shut off the free energy rivers. Now I can't prove. . .

It was because Tesla finally revealed to Morgan that he was going to give the world free energy. Morgan knew that would end his empire.

MC Do you mean that theory set up a conceptual block? When you say "shut it off" you don't mean physically shut it down, but rather shut off our ability to conceptualize it?

Bearden If you apply that kind of a theory and those kinds of principles you can never get free energy. My opinion is that J.P. Morgan, possibly Edison, hired that done.

MC [aside to Becraft] Do you notice the similarity in methodology? All the books with *unwanted* definitions and cases are taken out of the law libraries, the plates of old books were destroyed during World War II, ostensibly for lead even though we had a surplus of lead. What's being said is never changed. They change your ability to understand what the terms mean. It's *newspeak* right out of Orwell's *1984*. Remember what Stalin said? "The dictionary is the most important weapon in my arsenal."

Bearden Of course. If you read the Russian constitution, that would be a great constitution if they really abided by it.

MC Morally this is the same thing the Nazis did to the Jews. They just changed their definition. They defined the Jews as "non-persons", therefore it was not morally wrong to kill them, because they were not humans. This is exactly the same thing the US Supreme Court did to the unborn child in abortion.

Bearden Now as I say, I can't prove that, but it appears to me there was some kind of deliberate thing done by Morgan. Morgan was the local representative of the control groups, the hidden control groups.

Becraft The point Tom is making is that we're battling in our world, the world that you and I are in, fighting these apparent enemies. Tom knows about these apparent enemies, the Trilateral commission, etc., but he carries it a step beyond them, to the ones that no one knows about.

Bearden Gentlemen, I'll tell you this: their basic control mechanism upon which control of everything else is founded, control of finance, energy, etc., is the control of science.

MC Energy, though, in the sense of oil, pipelines, energy production. Let me make an analogy: money. If you walk up to the man in the street, and you ask him, "What is money?"

he pulls out those green pieces of paper, which are not money all. His ability to perceive that gold and silver are money not possible so long as he thinks in that paper money system. He can't perceive what gold and silver are.

Bearden You see, we used to have paper money which was promissory notes, promises to pay gold or silver, but they slipped that promise off of the notes. Now it's just a promissory note, but it doesn't say what they'll pay in.

MC The methodology is precisely the same, though, with controlling science or physics. So how did Morgan do it?

Bearden I'll tell you how I think he did it. Now I say, this is opinion. I can't prove it, so label it for what it is. There were only a very few graduate schools in electro-magnetics in those days. Remember this was 1904, you didn't have relativity yet, you didn't have quantum mechanics yet. You still had ether theory. There weren't really that many good electrical scientists, very few, and the best or about the best school was at Columbia, which was called Columbia College then. Now my personal opinion is, and perhaps someone else can prove it someday, they probably got to two professors at Columbia. That would have been all it would take to produce the books right, to produce the theory right.

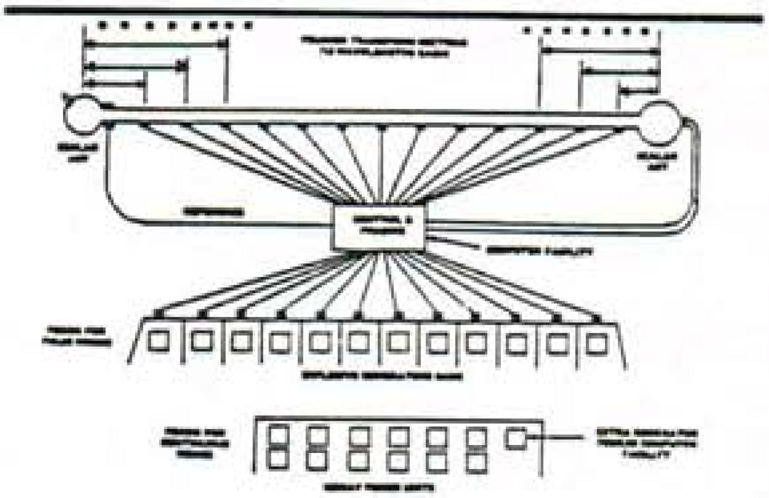
You're talking about faster than light travel, and matter transmission, and it's going to be cheap, real cheap.

MC Just like John Dewey in education.

arden Two people could have changed the course of history, but I can't prove they did. I'm saying they could have. And I believe Morgan did that, and the reason was because Tesla, in trying to get more money to finish that tower at Wardencliff had finally revealed to him that he was going to give the world free energy. Morgan knew, if all you could do was sell them an antenna, you couldn't sell them the energy, that would end his lock on energy and end his empire. I believe there have been hundreds of other scientists similarly crushed in pure mafia style. Tesla wasn't the only one. They made him a non-person by pulling the financial rug out from under him. Their fundamental keystone support is the control of science. Its not accidental that we get the hounds of hell on us when we come up with an heretical idea in science. It's not accidental that you can't get a dollar from the vast sums of money spent on the energy problem. Look at where the money goes. Nobody is doing research on what we're talking about. Physics verifies that a vacuum has plenty of energy. Just ordinary physics. Now the Russians have gone ahead and weaponized the whole area. The Bohm Aharonov effect proves that you've got this ordinary electromagnetics and you've got all this other stuff, too, that we don't know anything about in the West. All they've been doing in the West for the last 25 years is scratching their chins and saying, well, what do you know about that? What I've gone ahead and done is bluntly put out in black and white the most elementary thing: how to sum vectors to zero. And a zero vector by definition, since it's a gradient, has a potential. The tress in that potential is caused by these forces that I've put there, but I know what they are, they're not statistically varying all over the place, because I put them right where I want them.

Now here are two more kinds of resonances that aren't in the book. I pointed out this wave that I was making, this stress wave, this scalar wave, which is summed to zero has all kinds of vectors in it. I can put a million vectors in it. I can put every phone conversation in Huntsvile on one wire, but no normal detector can see it. But the one I pointed out in the paper will do it. You can create substructures within substructures within substructures. There is no limit to it. The interesting thing is that every new layer is another dimension of space. You're doing hyper-space engineering, going around ordinary space and time.

Item 1. TESLA WEAPON AT SARYSHAGAN (SCALAR POTENTIAL INTERFEROMETER)



MC You're talking about faster than light travel. You're talking abut matter transmission. Teleportation.

Becraft Star Trek! Warp Seven. "Beam me down, Mr. Spock!"

Bearden Of course. I'm saying it's all possible, and it's going to be cheap, real cheap.

Becraft Has there been an instance here in the US of the teleportation of mass?

Bearden Sure.

Becraft Would that be from, say, Chicago to, say, San Diego?

Bearden Oh, I don't know about that. I don't know about the Philadelphia experiment. I can say this. The Philadelphia experiment could have happened. I'm not saying it did happen . . .

MC What are you two talking about?

Bearden You know, this so-called ship that was made to disappear, by popping the heck of it with a great big ring around it. If that thing made a nice big zero vector, a nice big scalar wave, and they popped it just right, they would have blown it right out of this spacetime. You can break space time.

MC You're talking about breaking it in two and shoving something through?

Bearden Yes.

MC Now let me go back, you've ploughed up more snakes than I can handle. Let's talk about the Russians. We all know that they cannot solve their most basic economic problems, like feeding their own people. I think we all assume that the reason this threatening, bullyboy Soviet state exists is that it was created, according to the dialectical theory, to form conflict in the world and through that conflict to erect a New

World State. You're saying that the Russians are just about f control, and the power that's putting them out of con- t.. is their mastery of Tesla physics, the application of Tesla physics to weapons? What kinds of weapons?

Bearden They could destroy NATO in 15 seconds. There are weapons such as earthquake generators, scalar wave beams, Tesla howitzers, force fields, cold or heat explosions.

MC Why don't they?

Bearden Real simple. There are certain aspects of these weapons that make them extremely dangerous if you use too many of them. They backfire on you because you mess up spacetime, and you yourself exist in spacetime. Suppose you begin to induce volcanic activity and earthquakes and whole plates begin to rock. You could obliterate the whole face of the earth, just by inducing too many.

MC What about the Tesla howitzer and the force shield application of Tesla physics?

Bearden Simple. They're testing it around the world. You can pick it up out of the open literature everywhere, I quoted them in my paper. Nick Downy in Afganistan was looking toward Saryshagan and saw it three times.

MC Well, then , why don't they use it?

Bearden In about 1960 the Soviets had a great debate going about nuclear war, etc., it's my thesis that along about 1947 they really started hard work in this area. By the way, the Soviets have a philosophical predeliction toward Tesla physics, because it employs opposing forces. This is a natural fit to their philosophical *dialectical method that comes from gel through Marx. So they poured money into it like mad, since the 30s when they apparently stole the Moray device in Salt Lake City.*

MC Back to my question: what is it that prevents them from using the weapons?

Bearden They're not the only ones who have the weapons. There's another country that's had them since 1969.

The Russians are just about out of control, and Tesla physics is putting them there.

MC Who is that?

Bearden I can't say.

MC Why not the US? Surely the folks in power are not that stupid, or are they? Did they just slip up?

Bearden I just described, for example, a simple definition, where I said if I believe the way we model an electron in particle physics today, and I looked to see which way the electron moves and I saw that the electron is precessing, then therefore the other force out in the vacuum is longitudinal. Now either you have to admit the vacuum wave is longitudinal, or you have to throw away everything we ever knew about gyros and all those models. You can't have both, and yet how many hundreds of thousands of Ph.D.s in electrical engineering, electronic engineering, electrical physics, etc., have we trained that have not seen that simple thing?

1C You're saying the ability to perceive the importance of esla physics doesn't exist?

Bearden I'm saying we're too brainwashed when we begin. Part of it is fear of professional reputation, fear of professional ridicule. Scientists will hound the non-conformists out of their jobs.

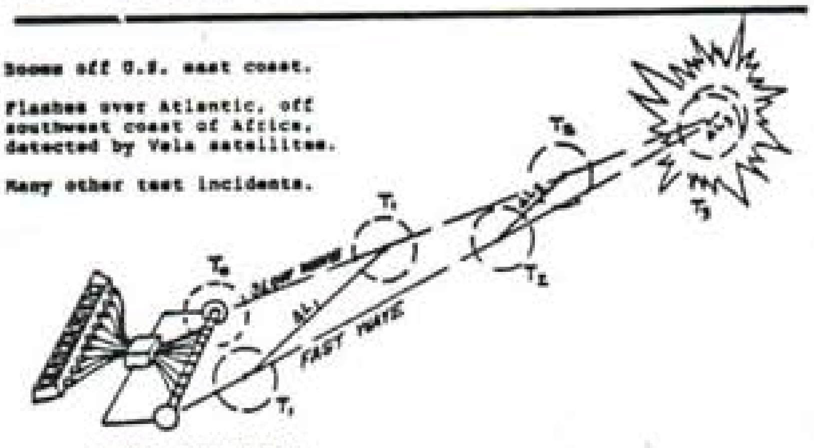
MC But the components of Tesla devices do not require some new manufacturing technology. It can all be built, free energy devices or weaponry, with off the shelf technology. No new, huge capital base is needed: you can build it with a machine shop.

Item 2. "NUCLEAR" FLASHES OFF THE COAST OF AFRICA

Booms off U.S. east coast.

Flashes over Atlantic, off southwest coast of Africa, detected by Vela satellites.

Many other test incidents.



TESLA HOWITZER
(SCALAR INTERFEROMETER)

-27-

Bearden You can build Bedini's free energy device for F$400 to F$500[Readers, for F$5.00 you can order *Bedini's Free Energy Generator*, a blueprint for a free energy device by John Bedini, from Tesla Book Company, 1580 Magnolia Avenue, Millbrae, CA 94030]. According to the Bohm-Aharonov effect, if two zerofield scalar wave beams are crossed in a distant region, real physical effects exist in that distant interference zone, without travelling through the space in between. It is the potential variation that is accomplished, not transmission of energy through space per se. This means you can transmit energy over vast distances, but not through wires or air or space. This has already been done in a proprietary laboratory. The only thing between the two is a scalar potential.

MC But if you're throwing out energy from a generating plant, why isn't there just an explosion at the focus, the point you're aiming at?

Bearden There is an explosion if you pulse it. That's what our VELA satellites detected in 1979 and 1980 off the southwest coast of Africa, as a so-called "nuclear flash". Or you can have a receiver to receive the energy and run motors and whatever.

MC You're talking about being able to "mine" the electric transmission wires for the metal in them. They won't be needed any longer.

Bearden Yes, and by the way, I can arrange the transmission system by setting my potentials the other way, so that I don't transmit energy to another point, but rather I suck energy out. That phenomenon on April 9, 1984, 200 miles from Tokyo off Japan, was a cold explosion, 150 miles in diameter, sucking energy out of the air, a massive cold explosion. There have been 77 other such cold explosions, picked up by our weather satellites since 1974 in the Soviet arctic in an area that has no volcanic activity.

MC Which is the way supposedly that the Soviets are engaging in weather control or modification?

Bearden It's one of the ways. It creates a massive low pressure cell. If I reach out and put energy in (instead of taking it out), you get what's called a high pressure cell. If I can reach out and cause lows and highs, I can control the weather all over the continental US. They've been doing it since early 1983.

Becraft This is something I've been talking to farmers about. I specifically watched the weather last year, and saw it in the unusual "behavior" of the trees, especially the hickories. Last year we had a real wet spring. Around here the hickory trees typically get hit by the bugs and they're full of holes by this time of the year. Last year we had a wet spring til June, then it just dried out. But the trees didn't show blighting, and the hickories stayed green where normally from the heat loss they'd drop their leaves by the last of August or first of September. They didn't do that, they hung on the trees, turned golden brown, and fell off in October. They were luxiurant like never before. Yet in travelling I watched the trees and crops all the way up to Chicago. They were devasted by the heat. In some parts of Indiana the crops just came up and fell over.

On April 9, 1984 there was a 150-mile cold explosion off the coast of Japan.

Bearden They wanted to ruin the US corn crop. Now how many years can you take that?

Becraft Tom, did they not do that from satellites?

Bearden They can do that from satellites, but they don't have that much power in most of the satellites. They can do it from Russia. It can be located as they will.

Becraft Can they not pick up satellite pictures and work an effect from those?

MC Now, wait, what are y'all talking about? Is this something new? Are you talking about the same thing that happened to the submarine Thresher?

Bearden You're talking about radionics. Radionics operators have known for a long time that if I have a photograph of you, I somehow have a very peculiar pattern exactly like you, a fingerprint. I can do things to this fingerprint. I can turn on my radionics machine, which produces scalar waves, and I can make those vibrations (undetectable by normal instruments) occur and then gradually I can produce changes, and these changes are measurable.

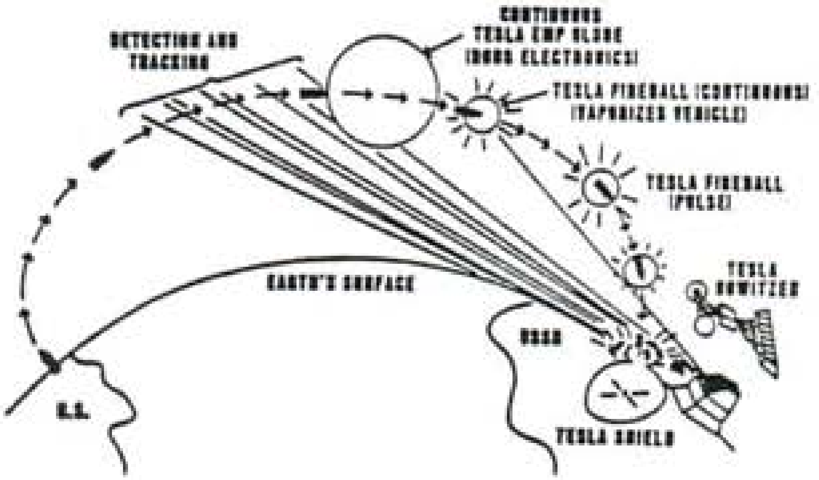
MC How does it work? Are we talking voodoo?

In 1984 or 1985 we could see starvation in this country.

Bearden We're not talking voodoo, we're not talking witchcraft, we're not talking mysticism, we're talking science. If I have for example, a tuning fork here tuned to C, and a tuning fork over there tuned to C, and I thump the first one to make it vibrate, the second one will vibrate by sympathetic vibrations. Now scalar vibration, scalar resonance, is not in the textbook, but you can understand it. I have here a vector pattern, summed to zero. Over there is an object with the same vector pattern, also summed to zero, but it will resonate to the same vector pattern. The human body is emitting its individual scalar patterns all the time. What the photograph does is to capture that scalar pattern by capturing the light which carries with it that pattern. The photo is an imprint of that exact pattern. Now if I take that pattern, measure and analyze the major parts, the big ones, and start them vibrating, guess what's going to happen to you? You'll have electrical patterns bubbling all over you. I could take the picture of a cancer, and superimpose that on you, and I'm going to give you cancer if I keep it going long enough. It is also possible to reverse this, and squelch the bad part of the pattern. Or it's possible, for instance, to take a picture of a field infested with bugs, put insecticide on the picture, and project a resonant pattern of that insecticide onto that field. In tests done with the field drawn off into grids, it killed the bugs in those grids treated on the picture with insecticide.

MC How does this transmitter work? What is radionics?

Bearden The discovery that you can take electrical machines (scalar interferometers) and get this kind of wave out of them and effect things at a distance. But we didn't have detectors to measure what the machine is putting out. Now suppose that we have lots of power, and I take a picture of the submarine Thresher. That's an exact fingerprint of that submarine. Now I kindle this effect with a powerful transmitter in Mother Russia using this picture pattern, and that Thresher finds tremendous energy tuned in on herself, heat or any other energy, electrical energy, and throughout her electrical system she has interference; it fails. They were in communication with that sub when she was lost, and the Skylark on the surface had severe interference with multiple communications systems. It was so bad that when they realized that the sub was gone it took over an hour and a half to transmit an emergency message. Everything they had was jammed from the splatter coming off the doomed submarine. That's a matter of record. We don't have anybody who recognizes that's a symptom of the kindling of interferometer-generated scalar waves.



MC I still don't understand why the Russians don't just go on and make their move.

Bearden They are. Look for it in 1985 or 1986. We could see starvation in this country.

MC You say that's the way they've chosen to do it?

Bearden Maybe. They are not going to do it with nuclear weapons, because they don't care about New York city or you and me, but they do care about that farm land and they don't want polluted, radioactive farm land. If I put a cold explosion on New York city, everybody freezes within seconds, regardless of their arctic clothing. Layers of clothing walls or electric blankets do no good because it sucks the eat out of every part of your body on the inside. There is o ier to it. You can't get in a foxhole or pillbox, it does o good because I can just place a cold explosion inside there d it sucks all the heat out and you freeze to death. A 150 ile diameter cold explosion just about covers the heart of ATO. Three or four of those across the front will just about o NATO in, before they ever start, and that's 15 seconds. hat you've got is soldiers who are frozen blocks of ice, it oesn't matter where they are. Nobody has to fire a nuke.

IC is there any shield against it?

earden Other scalar waves.

IC How do you know they're coming?

earden You don't. It's like two swords. What's the real shield gainst a sword? Another sword. He doesn't do it to you ecause you can do it to him. Talk about your balance of error? We just went up several orders of magnitude. If you on't have them you've got a problem. What's holding them ff right now is the other country that has them. Others may lso also have them right now. Anybody who seriously looks t this stuff with an open mind, no matter what his nationlity, can figure it all out just from the open literature.

IC This is sort of a depressing prospect. Where do we go rom here?

earden What have we unleashed here? There is no return. ve've gone through a one-way door. We have 2 immediate roblems. First we have to get our own systems moving real ast. We can have weapons in three or four months, once the noney's turned loose, and a year from now we could have id of weapons that would prevent them from ever being able to do anything to us. They wouldn't dare. And that's vhy I've gone so public, why I'm running this risk. If this ystem doesn't move, we are all dead. Not in 1990, not in 000, but in 1985 or 1986 if we're lucky. We are dead. This ttitude that we have 50 years to do it just won't work. The other problem is that this technology, unlike the atom bomb, s cheap, and every little Khomeini, every little dictator can nave it, so we have to solve the human problem.

IC Thank you very much, Col. Bearden. —F. Sanders

Readers who want to read any of Col. Bearden's numerous papers or further information about Tesla and Tesla physics can write to the Tesla Book Co., 1580 Magnolia Ave., Millbrae, CA 94030

pecial note: Nothing in the article above should be construed as ur approval of any occult, astrological, New Age, or parapsyhological reports, practices, or philosophies. As orthodox Chrisians we wholeheartedly condemn such practices based upon the vhole weight of Scripture. We reject the perfectability of man and s attendant delusions, and acknowledge one Sovereign God who ules the universe. We find that much of the late literature which urports to deal with Tesla physics drags in subjects and beliefs vhich are plainly outside the scope of physics or science as we nderstand them. Yet beneath this overlay of the bizarre there is ubstance to Tesla's discoveries, and the obvious conclusion that is work has not been exploited in subsequent scientific inquiry, ndeed has been apparently suppressed. We do not believe in peretual motion machines, but are faced with the reality of existing 's that operate at efficiencies in excess of 100%, even with ..... Bedini's blueprint for such a device. Anything this far out of he ordinary demands our thoughtful inquiry and careful attention. — F. Sanders.

UNVERGEßLICH
☞ UNFORGETTABLE
INOUBLIABLE

☞From the **Federal Register** Vol. 49, No. 138, page 28817, Tuesday, July 17, 1984 we draw this tidbit for those who still think Ronald Reagan is on their side. "Presidential Determination No. 84-11 of 6/12/84. Eligibility of China to make purchases and leases of defense articles and services under the Arms Export Control Act: Memorandum for the Hon. [sic] George P. Shultz, the Secretary of State. Pursuant to the authority vested in me by Section 3(a)(1) of the Arms Export Control Act, I hereby find that the furnishing of defense articles and services to the Government of China will strengthen the security of the United States and promote world peace [sic]. You are directed on my behalf to report this finding to the Congress. This finding shall be published in the *Federal Register*. [signed] Ronald Reagan." Now just in case you might be slow on the uptake, that's RED China he's talking about. You know, RED CHINA, that noted peacemaker that General McArthur fought in Korea, along with a few hundred thousand *American* Marines, soldiers and assorted Koreans. You know, RED CHINA, those peacemakers who supplied North Vietnam during the (test your memory now, see just how well you can *doublethink & bellyfeel) Vietnam "war". This is the same peace-loving RED CHINA that has the largest army in the world. The same group of peace-mongers who lovingly strangled, shot, stabbed, burned, flayed, drowned, exploded, hanged, and hacked to death over fifty million* of their own countrymen after their takeover in 1948. Isn't peace *wonderful*?

☞ From **Newsweek**, July 23, 1984. "*Are electronic food stamps on the way?* The US Dept. of Agriculture is preparing to test a food stamp system based on charge cards instead of paper coupons. Beginning in October, food stamp recipients in Reading, PA will be given white plastic cards, and their monthly quota of food stamps will be credited to a special account at a local bank. When a card holder buys food, the supermarket clerk will use an ordinary credit card reading machine to electronically debit the customer's food stamp account and credit the store's account. The USDA believes that the new system will make fraud more difficult while eliminating time-consuming paperwork." ☞ We've been saying for a long time that the long range goal of the government and the Federal Reserve is to eliminate *cash* from the financial system. Why? Because cash is freedom, and people cannot be well controlled if they are running around loose with their pockets stuffed full of green paper money . . . or even foodstamps. We speculate that the coming currency call-in about which we've written so much, is aimed in the not too distant future at a system in which there will be no cash. Rather your every purchase will be keyed through an electronic debit card system *already in place with many banks* and now being tested with foodstamps. Think about it. Just how free will you be if the only money you have comes through *one* account with *one number*? Just how likely will you be to go up against the government when all they have to do is cut off your account and you are without money? Is starvation an option? For your own sakes, read the handwriting on the wall and get some gold and silver, lots of it, in small, spendable denominations. While you're at it, ask us about the **Warehouse Exchange** and how it can get you *out* of the paper money, fractional reserve banking system.

☞ From **Don Bell Reports**, July 13, 1984, $40/year from Box 2223, Palm Beach, FL 33480 "The Establishment's accountants tell us that it's going to cost over a billion dollars to convince the people that they (the people) will have elected the persons they (the Establishmentarians) have already chosen, months ago, to become President and Vice President of the United States in 1985. That's not counting the additional millions it will cost the people to elect all of the Representatives and one-third of the Senators who will supposedly represent them beginning next year. Nor does it include the further millions it will cost the people to elect the State, County, and Municipal officers who will be running this year. Commenting on the federal extravaganza . . . Raymond Heaps . . . a representative of the American Independent Party, recently said, assuming the people really do have a choice, "The choice is clear. It is the choice of being rushed pell mell into Socialism or having it done more smoothly and efficiently. *President Reagan* has exceeded Jimmy Carter in funding socialist programs, has greatly increased foreign aid and the transfer of US high technology to America's avowed communist enemies [see the related determination by Prexy Reagan, above], and has neutralized the MX (intended to be mobile) missles by basing them in fixed silos . . . *Walter (Fritz) Mondale* has an established voting record that should qualify him for the Lenin Peace Prize with special commendation, and is supported by all of the Marxist-oriented union officials. *Gary Hart* differs from Mondale only in one way — he has renamed the same socialist plans as "new ideas". *Jesse Jackson* stands out as the darling of the left. In a news interview, Jackson said that his is supported by the *Rainbow Coalition*."' *New Age* watchers, that ought to be your tipoff.

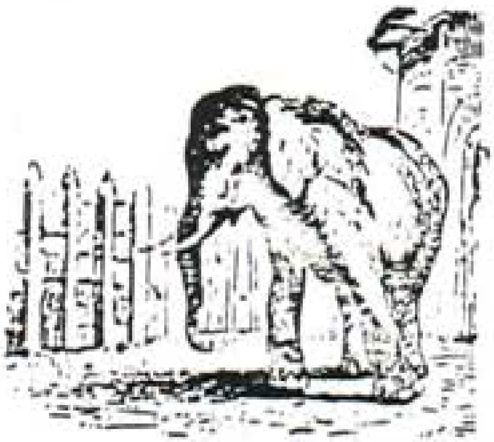
☞ From **Vertrauliche Mitteilungen aus Politik & Wirtschaft**, 7701 Büsingen, West Germany, July 5, 1984. "Now and then subscribers ask us for new revelations about the Personal Identification Number (666). More on this later in the summer. Today only a short notice from Emil Rahm's Swiss magazine *Memopress*, dated Feb. 1984: "American banks and concerns plan the numbering of every citizen. The planned 18 invisibly tatooed code numbers contain all data about the person. The plan was uncovered after several banks in the USA accidentally put the new forms into circulation. . . Art Bushkin, official of the American Commerce Department: "This whole electronic money transfer system is a means to a massive surveillance of the population" . . . The new system is supposed to be introduced into the whole western world. To facilitate the operation the establishment in Brussels of a giant international computer installation is planned . . headed up by the computer analyst Dr. Henrik Eldeman."' ❝ Look at it this way, dear Readers: think of all the money the government will save by not having to issue those white plastic cards to the foodstampers.

☞ From the *London Financial Times*, 6/20/84. "How to create a single European currency. The momentum that was once working towards a unified Europe has been lost . . . The one necessary condition is the creation of a true European currency. . . There is one way to improve the situation: *to introduce a parallel European currency* which could be freely exchanged by firms and households for other [European Common Market] currencies. . . There is already one European currency in existence today, even though still in its infancy: the Ecu (European Currency Unit). Starting with this, we propose a method of progressing to a single European currency . . . [in] three stages:

1. Extending the present use of the Ecu. . . Governments should begin to issue bonds in Ecus and express, at least partially, their public goods markets as well as some of their expenditures in Ecus. The private sector should also be encouraged to use the parallel currency. . . Banknotes or coins do not exist in the Ecu for the simple reason that no bank is entitled to issue them. . . This stage would enable financial, banking, and industrial organizations to institute the management and planning systmes necessary for widespread utilization . .

2. Here the aim is to make the Ecu an effective medium of exchange and therefore a real currency. . . This would allow the creation of a European Central Bank, which would emerge from the central banks of each country (or from the existing European Fund for Monetary Cooperation). . .

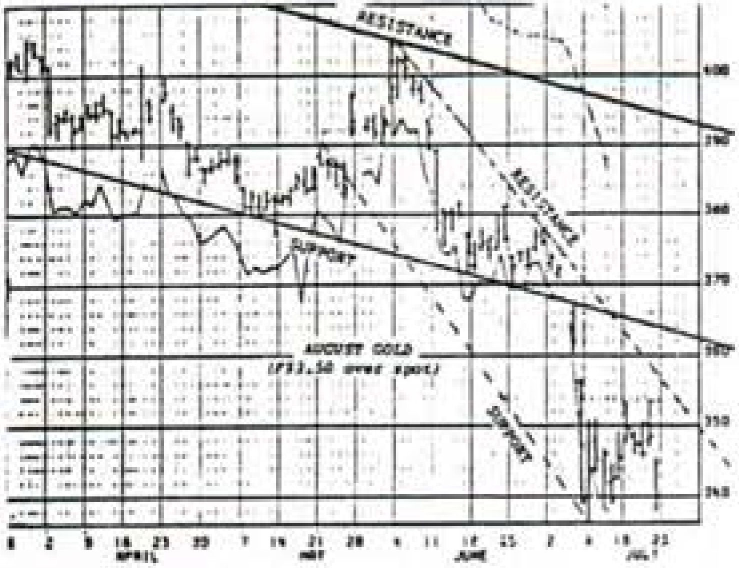
3. The third stage of our plan must be implemented as quickly as possible to minimize problems linked with the simultaneous existence of two currencies in each country. In this stage the Ecu is set up as the only European currency. The remaining national currency in each country should be withdrawn from circulation. Independent central banks should be closed down or, alternatively, given a status similar to that of a Federal Reserve bank [you know, what Cong. Lindbergh called *expensive mausoleums*] in the US monetary system. . . This European central bank should have a status that ensured its independence vis a vis the political system." ❝ If all this has a hauntingly familiar ring, dear Readers, it's because its the same old threadbare plot that the Elitists have been slobbering over since the 30s. First they called it the "bancor", then we got a halfway step with the dollar under the Bretton Woods agreement, then in the late 60s it was the SDR, then up pops the Ecu in the late 70s. So now the long-range goals become clearer. A single currency for Europe, and a currency call in for the US, Japan, Australia, New Zealand, Canada, West Germany, Great Britain, etc. Then from those new currencies someone will "discover" that things are working so well that we need yet another, SUPRANATIONAL, INTERGALACTIC, TRANSUNIVERSAL, HYPERCOSMIC currency that will work out all the bugs in the Trilateral . . . oops, I mean, international, financial system. Oh, and by the way, don't forget a matching *central bank* independent of the political system. We all know how well that already works in the US. So well, in fact, that we really ought to see if the converse works as well: *a political system independent of the central bank.*



☞ From a **Dean Witter Reynolds** newswire, 7/9/84. "New tax bill provisions seek to boost compliance with laws. The new tax bill expected to be signed soon by President Reagan seeks to encourage compliance with existing laws by making additional and more timely information available to the Internal Revenue Service and by raising tax evasion penalties. . . There is a new requirement that all [sic] businesses must report transactions in which they receive more than F$10,000 in cash." ☞ From *Remnant Review*, July 6, 1984, F$95/22 issues from Box 8204, Fort Worth, TX 76112. "The numbers tell us that the game can't go on indefinitely. Now, at long, long last, the *Wall St. Journal* has faced the music. The June 22 issue devoted a front-page story to the compound interest problem of the US federal debt. Then it offered an excellent five-page report in Sec. 2 to the international debt problem. The numbers tell the story: *there is no known way to escape a collapse*. The writers didn't say this openly, but they offered no solutions. We have problems without solutions. The only vaguely optimistic people they interviewed were officials or former officials with Latin American nations, and not all of them were optimistic. The optimists didn't say how the crisis could be averted; they just kept saying that "the worst is over' for now. The articles in the special report contradicted their optimism. *** Look, understand what this means. *Word is getting out.* *** I think it means that *the conventional financial community is being prepared for* **emergency orders**. The public is being told that "normal procedures' no longer offer solutions."

CURRENT MARKET PROJECTIONS

The removal of the 30% witholding tax on foreign deposits in the US broke the back of support in gold, silver, and the ign currencies. Once gold passed through the magic F$370 point a large drop was assured, and we got it with a gap down opening the day after the July 4th holiday. A scant three days' trading took the price all the way down to F$336 (basis July, F$3.50 higher than spot). For the past week the price has hovered around the F$342 - F$353 mark. How much farther can it go? Aside from testing the F$336 low, it could stop at F$315 - F$320 or go on down to retest the 1982 F$290 mark. We should see rising prices for at least another week, even if the market is going lower. Closes above F$356.50 and then F$368 are necessary to turn it upward again, although we could see considerable sidewise trading from here. Interestingly, in 1982 the market traded below F$320 only four weeks before beginning its upward climb back to F$500. You can wait for lower prices if you dare, but I think a wiser program is to continue to accumulate at these prices. It goes without saying that if Mondale wins the election the price of gold will go stratospheric. I even have some conservative friends who are threatening to emigrate to Nicaragua if he's elected.

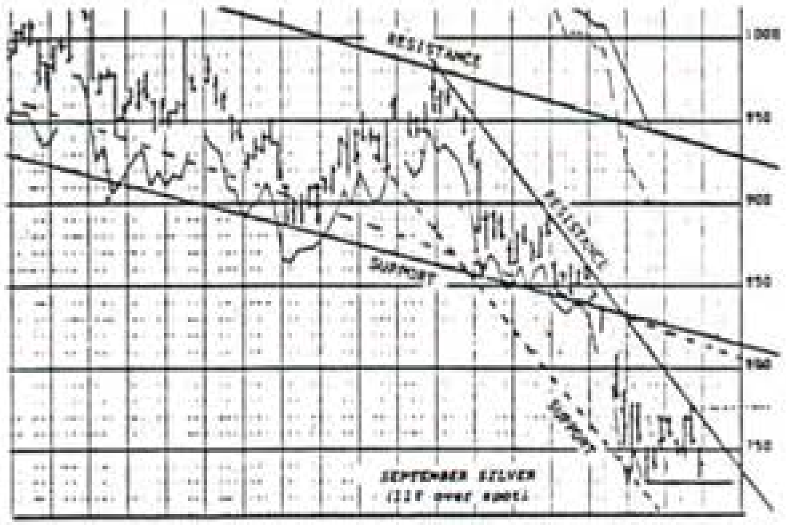


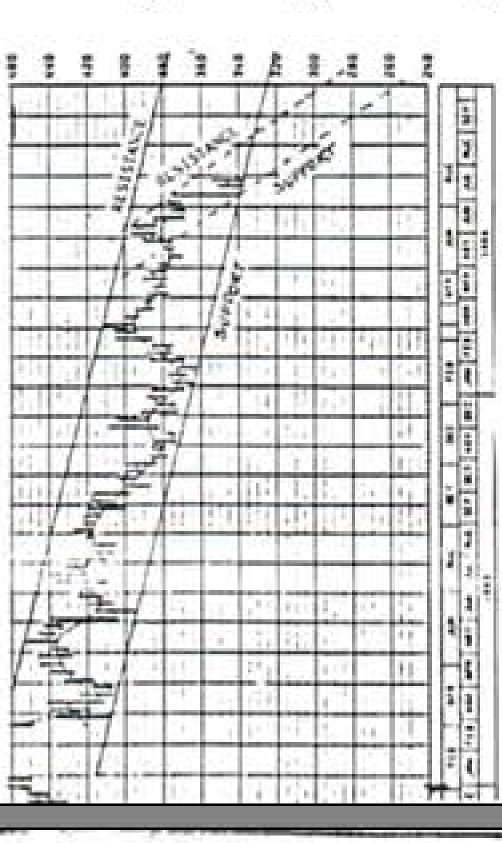
Silver fell down in lockstep with gold, widening out the ratio to around 47 to one. From the F$8.40 level five hair-raising days took the white metal down to F$7.29, basis September (11¢ above spot), from where it has rallied to trade in the neighborhood of F$7.40 - F$7.70. If the F$7.29 - F$7.20 level is broken, look for a drop to F$6.75, then an unbelievable F$6.00. Like gold, silver stayed under F$6.00 only four weeks in 1982. The upside breakout points on silver are closes over F$7.76 and then F$8.20

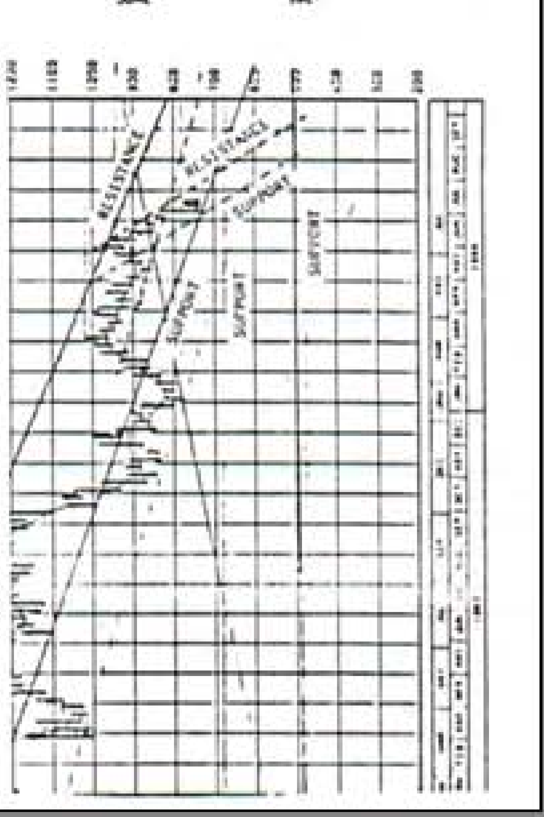
There are two negatives on the horizon. Since commodities across the board have dropped, we may be seeing the market signaling a more tremendous depression than the 1930s. I find this hard to compass because every chart and number I see still shows money creation proceeding at full steam. Look at the charts from the St. Louis Fed. I see no signs of a fundamental change in this policy. I can only side with the overwhelming bulk of historical precedent and say that there is no example of any inflation having gone as far as our own and ending in anything but hyperinflation. Rather than trying to pick bottoms, I would take these opportunities to trade paper dollars for real assets, namely gold and silver, before the next great, and probably final, burst of inflation. The only ther negative is that the bullish concensus, the average of the opinions of newsletter writers, is a bit too high to make calling a bottom comfortable.

At the very least owners of gold should take advantage of the present very high silver to gold ratio to trade some of their gold for silver. A realized rate of even 44 to one here, coupled with a trade back into gold at 35 : 1 or better, would net a *twenty percent increase* in the number of ounces of gold you hold. Long term resistance for the ratio is 50 : 1, tantalizing near the present 47. 47:1 was the previous high. Likewise silver to silver swaps are very attractive now. Trades from 90% silver coin into 40% coin are netting increases of 12 - 14% and more. I prefer trading into 40% rather than bullion, because if we do get a severe drop in silver the 40% halves will begin to take on a premium. Thus lower down we could trade yet again from 40% into silver bullion and realize yet another increase in silver ounces. It goes without saying that any holders of silver dollars should also at once trade into 40% or bullion, for increases in excess of 75% in ounces. DO IT NOW, since once prices begin to move upward the ratio will deteriorate rapidly toward 40:1 or lower and the premium on 90% coin and dollars will evaporate quickly.

By the way, consider the advantages of these swapping strategies. Suppose you bought a bag of silver (containing 715 fine ounces) for F$10,000 and the price dropped to F$6,500. At that price you can swap for 40% halves and realize an increase of, say, 15%. When the price of 90% bags again reaches F$10,000, you can swap back into 90%, at a total cost of perhaps 4%, for a net increase of 11%! That's about what you could get by joining the parimutuel pool down at your neighborhood fractional reserve bank where you're betting with everyone else that when you go to get your money they will still have some money left, but you would have had your reserves in silver the whole time and not run the risk of bank closure or collapse of the financial system. Of course the silver-gold strategy offers just as great a return. Just do us all a favor and don't spread the word about these trading strategies. When everybody else starts catching on the returns won't be as great. — F. Sanders







GOLD BASIS: $339.50
SILVER BASIS: 7.25

PRICE COMPARISON
CLOSING 7/23/64

	NET GOLD OR SILVER. CONTENT	We will buy @ COL.A	COST EACH 20 OR MORE Col. 1	COST EACH 5 - 19 Col. 2	PRICE/OZ. From Col. 1	% PREMIUM From Col. 1
AUSTRIA - 100 coronae	0.9802	$ 322.75	$338.50	$340.25	$345.34	1.7%
(or 20 coronae	0.1958	62.75	70.00	74.00	357.51	5.3%
Hung.) 4 ducat	0.4438	145.25	155.25	160.00	349.82	3.0%
1 ducat	0.1109	35.90	41.05	44.00	369.70	8.9%
CANADA - Maple Leaf	1.0000	343.00	359.50	361.00	359.50	5.9%
1/4 maple leaf	0.2500	88.00	93.50	96.50	374.00	10.2%
1/10 maple leaf	0.1000	35.00	38.75	44.00	387.50	14.1%
GREAT BRITAIN - sovereign	0.2354	80.00	87.00	90.00	369.58	8.9%
MEXICO 50 peso	1.2057	414.25	433.75	436.00	359.75	6.0%
20 peso	0.4823	159.25	173.00	177.00	358.70	5.7%
10 peso	0.2411	78.25	86.50	90.50	358.77	5.7%
5 peso	0.1206	40.00	46.00	50.00	381.43	12.6%
2-1/2 peso	0.0603	20.50	24.25	27.25	402.16	18.5%
2 peso	0.0482	16.25	19.85	26.00	411.83	21.3%
1 ounce	1.0000	343.50	360.75	363.60	360.75	6.6%
1/2 ounce	0.5000	173.25	182.75	187.75	365.50	7.7%
1/4 ounce	0.2500	88.25	94.25	98.25	377.00	11.0%
SOUTH AFRICA - KRUGERRAND	1.0000	343.00	359.50	361.00	359.50	5.9%
1/2 Krugerrand	0.5000	177.00	184.50	189.50	369.00	8.7%
1/4 Krugerrand	0.2500	89.00	93.50	96.50	374.00	10.2%
1/10 Krugerrand	0.1000	36.25	38.75	44.00	387.50	14.1%
Two rand	0.2354	77.50	85.00	89.00	361.09	6.6%
U.S.A.- $20 Liberty, XF	0.9675	418.00	525.00	548.00	542.64	59.8%
$20 Liberty, Uncirc.	0.9675	556.00	675.00	691.00	697.67	105.5%
$20 St. Gaudens, Unc.	0.9675	656.00	780.00	791.00	806.25	137.5%
ONE OZ. BULLION .9999 FINE	1.0000	335.50	353.50	356.00	353.50	4.1%

SILVER			[1]500 OZ.or $1000 BAG	[2]LESS THAN 100oz.or$250	PRICE/OZ. FROM Col.1	% PREMIUM From Col.1
US 40% half dollars	0.295/$1	$2,030.00	$2,380.00	$2,480.00	$ 8.07	11.3%
US 90% coin	0.715/$1	6,360.00	7,045.00	7,245.00	9.85	35.9%
US dollars, circ, VG+	0.765/$1	10,600.00	11,650.00	12,150.00	15.23	110.1%
Engelhard or SUNSHINE	100. oz.	725.00	785.00	810.00	7.85	8.3%
bullion, .999 fine	10. oz.	73.50	83.00	85.00	8.30	14.5%
(Prospectors)	1. oz.	7.41	8.25	8.40	8.25	13.8%

NOTES: Column 1 gold coin prices are based on round lots of twenty or more coins. For one gold coin of any size, add $5.00 to column 2 prices. for 2-4 coins, add $3.00. All prices include commission but not postage. 1. Minimum 500 oz. or one-fourth bag. 2. Col. 2 silver prices are good from $250 face value through $100 face value, or for one 100 oz. bar. Smaller quantities slightly higher. Column A. prices are our offer for twenty ounce gold lots or 500 oz. silver lots. Smaller quantities may be at lower prices.

Summer Special!
For immediate sale one (1) '77 VW Bus
7,000 miles; good engine; good transmission; new tires.
Test drive and see for yourself!
$2,500.00
(901) 755 5851

MUNDAY, MUNDAY

Recently you may have heard a new voice at SOS-GOLD. That voice belongs to Robert S. Munday, B.A., M.A., gentleman, theologian, educator, historian and student of politics. Soon to be Ph.D., Mr. Munday counts much in our operation. His steady, thorough competence and quick mind are a welcome addition to our often frenzied workplace. Mr. Munday brings with him varied experience and seasoned skills as a private investor. We welcome Mr. Munday and trust you will soon have an opportunity to avail yourself of his services.

IMMEDIATE SWAP RECOMMENDATIONS

At the very least owners of gold should take advantage of the present very high silver to gold ratio to trade some of their gold for silver. A realized rate of even 44 to one here, coupled with a trade back into gold at 35 : 1 or better, would net a *twenty percent increase* in the number of ounces of gold you hold. Long term resistance for the ratio is 50 : 1..tantalizing near the present 47. 47:1 was the previous high. Likewise silver to silver swaps are very attractive now. Trades from 90% silver coin into 40% coin are netting increases of 12 - 14% and more. I prefer trading into 40% rather than bullion, because if we do get a severe drop in silver the 40% halves will begin to take on a premium. Thus lower down we could trade yet again from 40% into silver bullion and realize yet another increase in silver ounces. It goes without saying that any holders of silver dollars should also at once trade into 40% or bullion, for increases in excess of 75% in ounces. DO IT NOW, since once prices begin to move upward the ratio will deteriorate rapidly toward 40:1 or lower and the premium on 90% coin and dollars will evaporate quickly.

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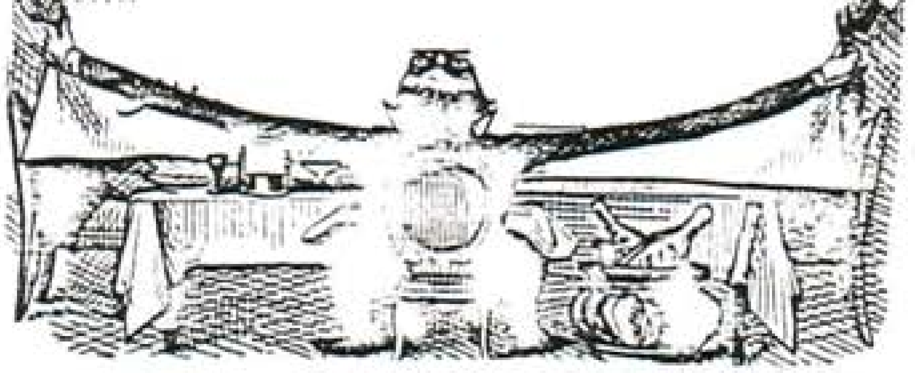
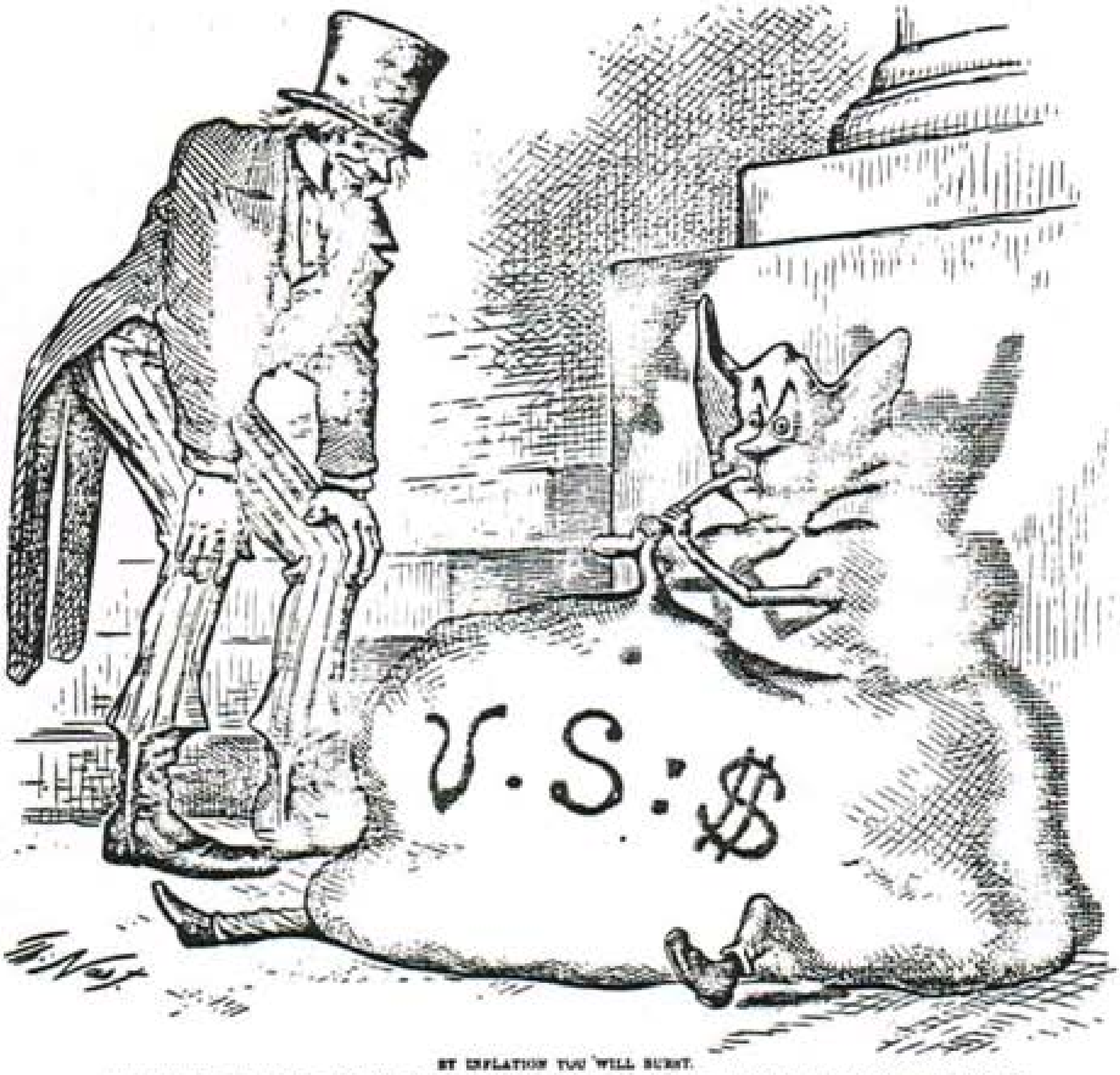
THE 100% RESERVE

If any of you, dear readers, are not concerned about system-wide bank failure, you should be. Our problem is, how to protect our cash reserves and savings, and still have enough paper money, in a convenient form, to pay usual expenses. If you take your paper money to a conventional Federal Reserve System bank, you have to play the fractional reserve game: for every dollar you put in, *they loan out eight*. In effect, you take part in a Ponzi-scheme, chain-letter operation in which you *hope* there will still be some money left when it's time for your to make a withdrawal. Although not a bank, the Warehouse Exchange offers you a way to keep your reserves in gold and/or silver, and maintain convenient liquidity at the same time. Better still, the Warehouse Exchange is part of a First Amendment association, the National Commodity & Barter Association, dedicated to monetary and political reform in the United States. For more information, write to the Southern National Warehouse Exchange, 868 Mt. Moriah, Suite 205, Memphis, Tennessee 38117.



We Regret to Announce

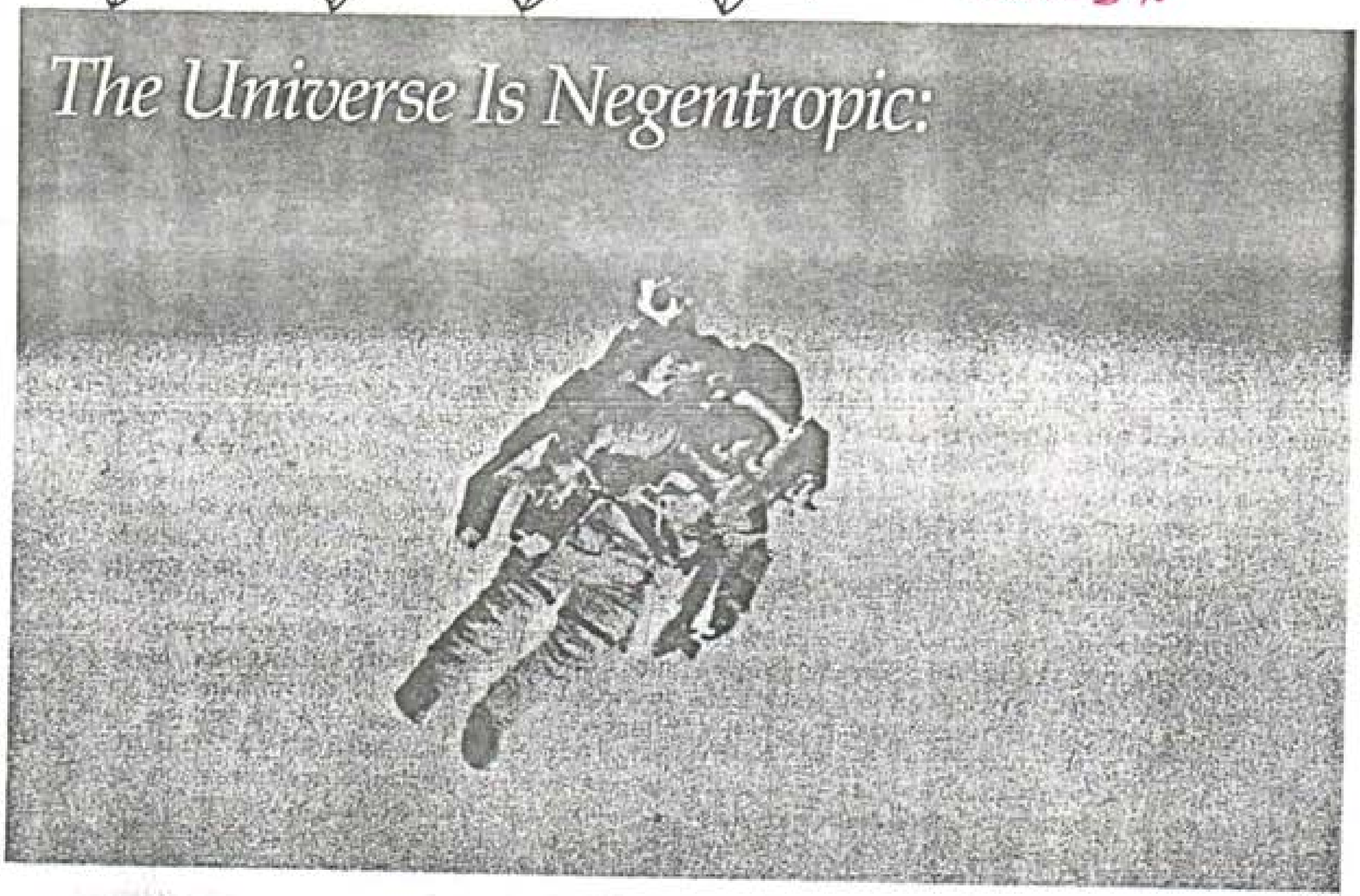
. . .that we must raise our commission rate effective immediately for all transactions involving any bank paper. We have never before raised our commission rate, and ask you to note that the rates are *unchanged* if you pay by *bank wire or cash* (green paper money). The commission rates are 1% higher for any trade which is settled by bank cashier check, traveller's checks, personal checks, money orders, etc. We appreciate your cooperation.



BY INFLATION YOU WILL BURST.

Uncle Sam. "You stupid Money-Bag! there is just so much Money in you; and you can not make it any more by blowing yourself up!"

Jean: The idea of the Golden Rule or Fibonacci series in free energy is not new, but the ideas on layout in these articles are the best I have found. John Retzlaff


NASA

The Universe Is Negentropic: How Man Transforms The Laws of the Universe

by Dr. Jonathan Tennenbaum

Three opposing views of the nature of the Universe have dominated recorded history to date.

One view, which has grown to virtual hegemony over the last 100 years, holds that the Universe is a great empty space—a great "pot"—filled with various kinds of objects, such as particles, force fields, atoms, molecules, planets, stars, and galaxies. These objects are assumed to be "interconnected" by *fixed, unchangeable physical laws*, in such a way that the entire Universe might be likened in its time-evolution to a gigantic machine.

This view of the Universe seems so natural and self-evident, that most of us could hardly imagine that it might be totally wrong! Is it possible that the Universe might be a *completely different sort of being* from anything our habitual modes of thought permit us to conceive? Busy with our daily lives, most of us are happy to hold on to habitual prejudices concerning the nature of the Universe. We go through life, so to speak, with a big pot over our head. Not so for Plato, Nicholas of Cusa, Leonardo da Vinci, Kepler, and Leibniz. These founders of modern science conceived of the Universe in a different way, as an "ontological transfinite," a *process of creation*. The Universe—according to this view—is not a "thing" or collection of "things," but an ongoing "composition," unfolding in agreement with an invariant creative principle, according to which *every momentary state of creation is limited as to perfection only by the lack of what is yet to be created*. The Universe continually modifies its own characteristics of action, inevitably diverging from the machinelike behavior prescribed by any fixed set of mathematical laws.

This quality of development, called "transfinite" by the 19th century Platonic mathematician Georg Cantor, is not merely a property of the Universe. On the contrary, transfinite development is the substance of the Universe; it is ontologically primary. Man is able, through the exercise of his divine potential for creative thought and action, to intervene into this process and willfully transform and accelerate it. Thereby, man acts as "God's little helper" in the ongoing composition of the Universe. This does not mean that the Universe obeys no law, but rather that the successive transformations of the universe, corresponding roughly to ordered series of changing physical laws, are ordered according to an invariant principle, a principle congruent with Plato's "Hypothesis of the Higher Hypothesis," the "Non-Other" of Cusa, and the "Principle of Sufficient Reason" of Leibniz.

As difficult or even obscure as this second view of the Universe might seem to many people today, it constitutes, demonstrably, the most essential basis of Judeo-Christian civilization for two millennia. However, it would be wrong to ascribe the "ontological transfinite" uniquely to Western culture, to consider it as a mere religious issue, or otherwise to attempt to circumscribe its domain of application. Not only is the essential conception of the "ontological transfinite" far older—perhaps tens of thousands of years older—than Plato's Academy: *This notion is the common heritage of mankind insofar as man distinguishes himself from the beasts*. It forms, in particular, the methodological foundation for the entire development of science and technology, from the very earliest times until today.

Throughout history, there have been people who disliked the notion of the "ontological transfinite," circles who devoted and continue to devote tremendous efforts in attempts to stamp it out of existence. In Greek times, the evil Hesiod demanded that science and technology be outlawed, and concocted a falsification of the ancient saga of Prometheus to gain authority for his demand. To this day, the successors of Hesiod, the advocates of enslavement of the world to the arbitrary will of a tiny oligarchy, have always regarded the "ontological transfinite" and the included Promethean view of man as the most dangerous of all political ideas. The "limits to growth" propaganda of the infamous Club of Rome, the efforts of Bertrand Russell and the Vienna positivists to destroy the Platonic current in continental science, and the periodic epidemics of religious fundamentalism of all kinds, are all products of the millennia-old oligarchical inquisition against the "ontological transfinite."

Today, this inquisition gloats over what it believes to be its final victory. A tidal wave of irrationalism threatens to sweep civilization off the face of the Earth—irrationalism typified by Ayatollah Khomeini's Islamic Revolution, sending its children and older people to be "purified" through human wave assaults against Iraqi machine guns; or by the blood and soil "Mother Russia" ideology of the Soviet Union, obsessed by the dream of building a world empire upon the ruins of Western civilization; or by the so-called peace movements in the West that demand that what is left of this great civilization be abandoned, defenseless, to fascist holocaust. Not content to merely suppress the concept of the "ontological transfinite" within our culture, the oligarchists have cultivated and propagated a third, irrationalist view of the Universe, *a view that radically rejects any comprehensive lawfulness*. Each process has its own lawfulness, independent of all others except insofar as it partakes of a mystical "unity of all things." So, we are witnessing a replay of the declining Roman Empire's pagan orgies, a revival of Hitler's "Triumph of the [Irrational] Will." Even qualified scientists, blinded epistemologically by the suppression of the "ontological transfinite," fail to recognize this irrationalist assault within the body of science itself, an assault typified by Nobel laureate Jacques Monod's *Chance and Necessity* and Nobel laureate Ilya Prigogine's *New Alliance*.

The purpose of this article is to assist the reader in attaining a grasp of the "ontological transfinite." In doing so, we hope to make a contribution to the survival of civilization.

Our discussion proper begins with a proof, developed by Johannes Kepler on the basis of a line of thought going back to Plato's *Timaeus* dialogue, that the universe is negentropic: *The universe as a whole has the same characteristics of self-development that otherwise characterize living organisms*. Kepler's proof provides the basis, in turn, for elaborating a *geometrical language*, by whose means the distinction between *energy* and *work*, crucial to the notion of the "ontological transfinite," can be precisely formulated. This result is accomplished through an examination of several profound, though entirely elementary contributions of Gottfried Leibniz, Karl F. Gauss, Bernhard Riemann, and Georg Cantor. Then, we apply the geometrical language to the consideration of the entire Universe as a single work-process, a system doing work upon itself so as to generate new singularities and increase its potential to do work. To pose this point in as provocative a fashion as possible, we have chosen to treat it in the context of a consideration of how mankind might, one day, accomplish a net change in the laws (or characteristics of action) of the Universe. The article closes with a brief review of the process by which, over the last 100 years, the notion of the ontological transfinite has all but been eliminated from the teaching and practice of science.

Kepler's Proof: The Universe Is Negentropic

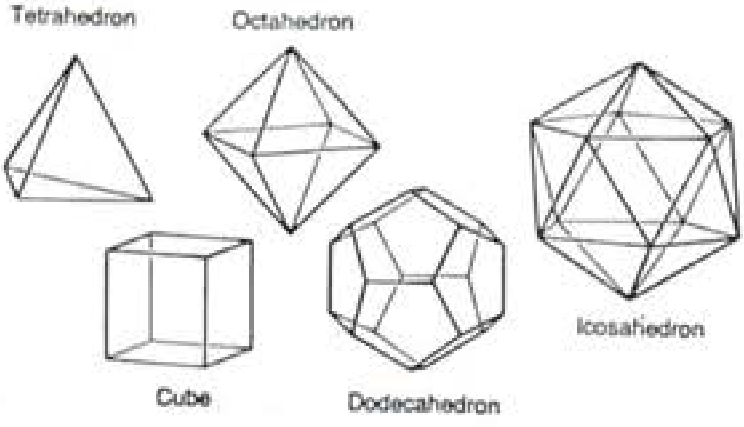
In the years 1595-1621, Johannes Kepler assembled conclusive proof that the Universe as a whole shares the same fundamental characteristics of growth and development that otherwise characterize living processes within the Universe. In other words, not only does our Universe contain negentropic processes, but the Universe itself is negentropic, or self-developing.

Although the proof is experimental, no expensive equipment is required. The necessary crucial experiments were carried out starting around 500 BC, and completed in their essentials by Kepler himself at the beginning of the 17th century.

Experiment Number 1: Determination of the fundamental characteristics of visual space. This experiment was completed some years ago by the priests of the Egyptian Temple of Ammon, and reported on by Plato in the dialogue *Timaeus*. To set up the experiment, we consider first the manner in which the processes of the Universe present themselves to our visual-sensory apparatus. At this level, we see the Universe in terms of motions of discrete object-images sitting around in empty space (visual space). Call this manifold of appearances the *discrete manifold*—the manifold that naive and unsuspecting people often tend to confuse with the whole Universe. The priest-scientists of

Figure 1
INCIDENCE MATRICES OF THE PLATONIC SOLIDS

Solid	Number of Sides	Number of Edges	Number of Vertices	Edges per Side	Sides per Vertex
Tetrahedron	4	6	4	3	3
Cube	6	12	8	4	3
Octahedron	8	12	6	3	4
Dodecahedron	12	30	20	5	3
Icosahedron	20	30	12	3	5



the Temple of Ammon posed the question: does the discrete manifold have identifiable, invariant characteristics, from which conclusions might be drawn concerning the nature of the Universe?

Considering that the characteristics of a manifold are revealed or expressed by those constructions that are possible or impossible within it, the Ammon investigators examined the construction of simple symmetric bodies, the regular solids. The significance of the regular solids is best located, in terms anticipating the later development of elementary topology, as follows: A body bounded by plane surfaces possesses four orders of singularities: the body itself (the interior), the bounding surfaces (faces), the line segments formed by the intersections of the faces (edges), and the points formed at the intersections of the edges (vertices). The simplest case arising for consideration is that of a "homogeneous" body in which all faces have the same number of edges, and every vertex adjoins the same number of faces.

For example, a rectangular box possesses six faces, each with four edges; each of the eight vertices formed at the intersections of the edges adjoins three faces. The array of integers that give the numbers of the various types of singularities and their mutual relations (that is, the number of faces adjioning a vertex) is called the *incidence matrix* of the body. Now, we can ask, given a proposed array of numbers, is it possible to actually construct a body in discrete space having the given array as its incidence matrix? If so, can the construction be realized by a perfectly symmetric body, a regular solid, in which all faces and edges are identical?

The Ammon scientists provided the crucial part of the answer: Out of all conceivable incidence matrices, there are only five that actually correspond to constructible regular solids in the discrete manifold! These five types of solids, now known as the Platonic solids, have the incidence matrices shown in Figure 1.

In the 18th century, Leonard Euler completed the Temple of Ammon's solution by showing that these five incidence matrices completely exhaust the possibilities of bodies (regular or not) constructible in the discrete manifold. In other words, every homogeneous body that can be constructed in the discrete manifold is just one of the five Platonic solids, possibly deformed out of symmetrical shape. (For example, the rectangular box is a deformed cube). The five Platonic solids are thus the "normalized" models of all constructible homogeneous bodies in the discrete manifold.

The implications of the Temple of Ammon discovery are earthshaking. The discrete manifold must be limited in some way, such that any attempted construction of a "sixth" regular solid runs into a curious obstacle—the discrete manifold is not "big enough." The five Platonic solids exhaust the possibilities of visual space, they are characteristics for the discrete manifold and its peculiar limitation, its "boundedness."

The courageous mind draws a further earthshaking conclusion: If the discrete manifold is bounded in a certain way expressed by the five solids, then the discrete manifold cannot be the whole Universe; there must be an unseen, underlying process that generates the discrete manifold in such a way that its characteristics are those discovered by the Temple of Ammon, and none other. In particular, physics like that of Ludwig Boltzmann, which attempts to interpret reality in terms of "interactions" between discrete bodies in visual space, is absurd. Reality lies outside the manifold of appearances, in unseen processes that determine not only the apparent behavior of discrete objects, but the form of visual space as a whole.

"Wait a minute! Why must you invoke mysterious, unseen forces to explain the Platonic solids?" the skeptical reader might ask. "The reason that there are no more regular solids is just because space is three-dimensional; our space is completely described by a Cartesian coordinate system, where the position of every point is specified by its coordinates x, y, z. Space is just the set of all triples (x, y, z) of real numbers. What could be more basic than that? What is there to explain? Why do you insist on making everything so complicated?"

Dear reader, you are suffering from a mind-dulling disease known as "mathematical indifferentism." Just because something seems self-evidently simple and basic does not make it so in reality. To the victim of "mathematical indifferentism" nothing could be simpler than a point or a number, nothing more self-evident than a pointlike "elementary particle"; yet, in reality, points and numbers are not simple, and the so-called elementary particles are actually tremendously complicated. Nicholas of Cusa settled the issue in 1440 in his epistemological treatise *Docta Ignorantia*: Only the Universe as a whole, reality itself, is elementary—everything within the Universe is more complicated, more composite. No part of the Universe can exist by itself; the existence of everything in the Universe is predicated on the existence of the Universe as a whole, which is the "minimum," the irreducible quantum of reality. Points exist only

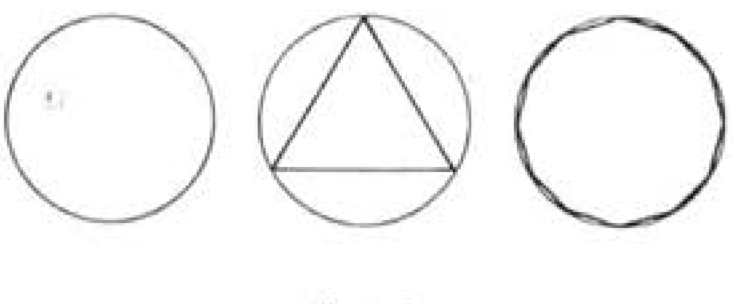


Figure 2
CUSA'S CIRCLE
Nicholas of Cusa's geometrical representation, showing that human reason is not attainable through mere logical thought: If we attempt to approach a circle (reason) through construction of polygons with more and more sides (logical thought), it might be thought that we would actually get closer and closer to a circle. Nonsense! A circle has no angles; the more angles we add to the polygon, the further we are from a circle.

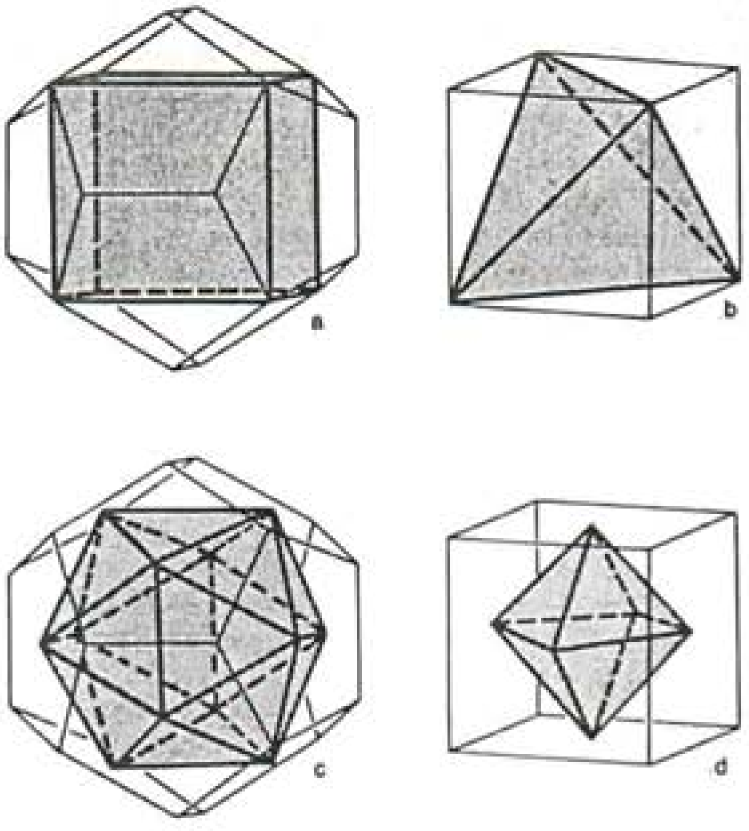


Figure 3
PRODUCING THE FOUR OTHER PLATONIC SOLIDS FROM THE DODECAHEDRON
If a diagonal is drawn through the pentagonal face of the dodecahedron, a cube is produced (a). Proceeding in the same way, a tetrahedron can be produced from the cube (b). If the midpoints of the faces of the dodecahedron are joined, an icosahedron is produced (c), and in the same way, an octahedron can be produced from the cube (d).

as determined singularities of processes; numbers exist only when some process generates singularities to count and measure. Three-dimensional Euclidean space only seems self-evident and elementary to you because your culture and your state of mind have so far determined that it should seem so. Science begins, on the other hand, with the questions: What makes things the way they are and not some other way? How can we intervene to change them for the better?

As long as mathematical indifference does not blind us, the implication of the five Platonic solids is inescapable: Some process is responsible for the observed characteristics of the discrete manifold—characteristics that are summed up in the existence of no more and no less than five regular constructible solids in that manifold.

Experiment Number 2: The proportion of the golden section. Chief among the proportions defined by the five regular solids is the golden mean or golden section, which is expressed mathematically by k, or $(1 + \sqrt{5})/2$, or 1.682. The golden section is found to predominate among the proportions assumed by living processes in the visual domain but is not found among the proportions typically assumed by inorganic processes on the Earth. The investigations leading to these results were begun in Greek times (or earlier), investigated in great detail by Leonardo da Vinci and his mathematics teacher, Luca Pacioli, and completed by Johannes Kepler.

Figure 3 shows how all the Platonic solids derive from one of the solids, the dodecahedron. The pentagonal faces of the dodecahedron are characterized by the golden section proportion, whose basic properties are summed up in Figure 4. In particular:

(1) The internal symmetries of the pentagon dictate that if B denotes the diagonal and A denotes the side of the pentagon, then $A:B = B:(A + B) + B$. The proportion $A:B$, which is uniquely determined by this relation, is called the *golden proportion* or golden section (4a).

(2) Successive addition, beginning with a golden proportion $A:B$ and generating $A + B = C$, $B + C = D$, $C + D = E$, and so on, creates a self-similar geometric series: that is, a series satisfying $A:B = B:C = C:D = D:E =$, and so on. This series corresponds to various series of pentagons that can be generated from a single pentagon by extension (4b).

(3) This form of growth, in which previously generated dimensions are added in such a way that the sequence of derived shapes grows by a constant proportion, is called simple homothetic growth. Such a process always leads to golden section proportions.

(4) Detailed study of simple living organisms reveals a wealth of homothetic growth processes and related variations. Correspondingly the golden proportion is found throughout nature in the forms of single-celled organisms (for example, pentagonal plankton), flowers, trees, animals, and even in man (Figure 4 e).

(5) The simplest schemes of population growth—for example, the progeny of a pair of rabbits—lead to the so-called Fibonacci series—1, 1, 2, 3, 5, 8, 11, and so on—whose successive ratios—1/1, 1/2, 2/3, 3/5, 5/8, and so on—converge very rapidly to the value of the golden section. Many-celled organisms governed by such cell-population

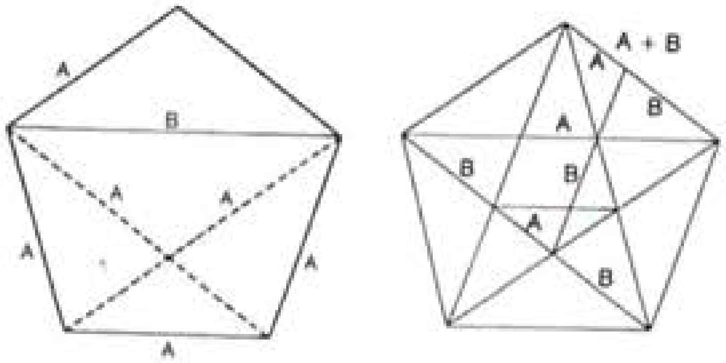


Figure 4a
THE PENTAGON AND THE GOLDEN SECTION

The proportion B:A of the length of a diagonal of a pentagon to one of its sides is the golden section. The triangle that this diagonal makes with two sides of the pentagon is called a golden triangle. If the sides of the pentagon are extended, then a larger pentagon is produced with side (A + B). The proportion (A + B):B of the length of side of the second pentagon to the diagonal of the first is also the golden section. The diagonals of the second pentagon are of length (A + B + B). The proportion (A + B + B):(A + B) of the length of these diagonals to the sides of the second pentagon is also the golden section, so that:

$$B:A = (A + B):B = (A + B + B):(A + B).$$

This geometrical construction illustrates the simultaneous additive and proportionate properties of the golden section. The progression of lengths in golden section proportion to each other—A, B, A + B, A + B + B—is obtained by addition. If A = 1 and B = k, the golden section, then $1 + k = k^2$.

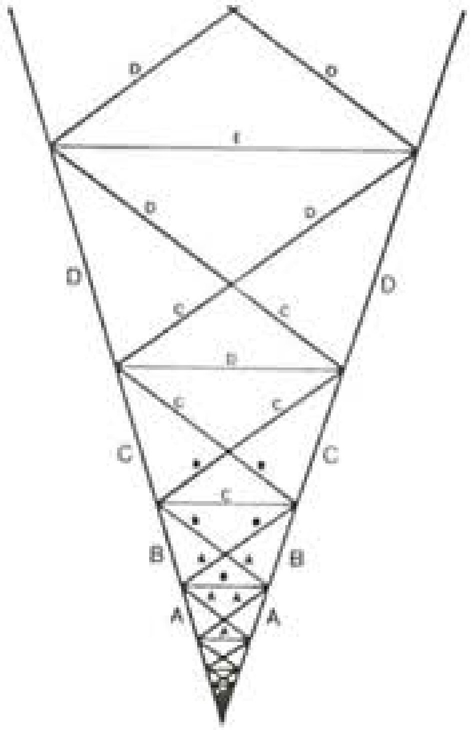


Figure 4b
PRODUCTION OF A SELF-SIMILAR SERIES
FROM A GOLDEN SECTION

Constructed according to the procedure outlined in 4a, every triangle symmetric to the axis of the cone is a golden triangle.

$C = A + B$, $D = B + C$, $E = C + D$, and so on, and $A:B = B:C = C:D = \ldots$

growth laws therefore automatically tend toward golden section proportions. (See Figure 4 f.)

(6) On the other hand, inorganic bodies such as crystals show no preference for the golden section. Typical symmetries in the inorganic domain are cubical and hexagonal, not pentagonal. Comparing the hexagonal form of crystals such as the snowflake, with the pentagonal form of the starfish (or simple plankton), Kepler was led to conjecture that the emergence of living organisms was accompanied by a shift away from "dead" crystalline hexagonal symmetry toward the golden-mean dominated pentagonal symmetry (Figure 5).

What conclusion must we draw from the above evidence? The discrete manifold is characterized as a whole by the dodecahedron-golden mean proportion, a proportion that otherwise is shared only by living processes manifested "locally" within the discrete manifold. Hence, the underlying process responsible for the characteristics of the discrete manifold as a whole must be a growth process akin to that of living organisms. This is Kepler's proof of the negentropic character of the Universe. Given this, the whole hierarchical construction of post-1865 physics tumbles to the ground.

Thanks to the efforts of Kepler, his predecessor Nicholas of Cusa, and his successors Wilhelm Gottfried Leibniz and Karl Gauss, we are now in a position to develop a geometrical language—the language of conical functions—by means of which we can formulate precise hypotheses concerning the nature of negentropic processes and work in the Universe. We shall now present the essential steps leading to the creation of that language, and return at the end of our labors to specify, using that language, how the predicted changes in the laws of the Universe will be accomplished.

Rotation and Work

In his *Harmony of the Universe*, Kepler expanded his proof of the negentropy of the Universe to discover the necessary connection between the underlying action of creation in the Universe and the action of *rotation* in the visible, discrete manifold. Specifically, Kepler observed the following: The harmonic ordering of the discrete manifold, as expressed by the five Platonic solids, can be entirely derived from the circle, by rotation. Because the circle itself is generated by rotation, that means that rotation—taken as a process of generation—uniquely coheres with the underlying negentropic action responsible for the observed characteristics of the discrete manifold.

The generation of the elementary geometrical construc-

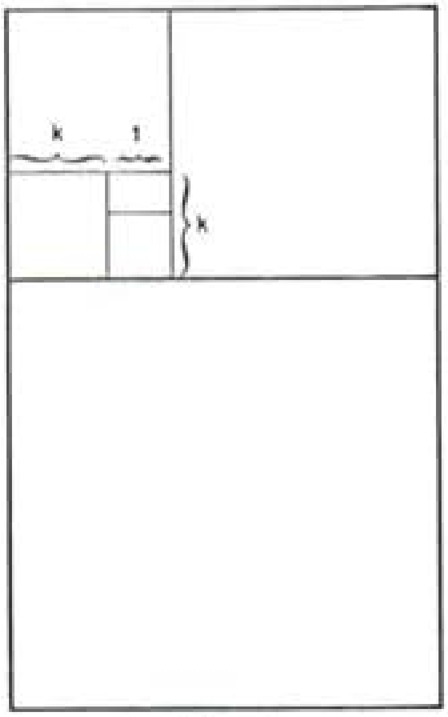


Figure 4c
SELF-SIMILAR GROWTH CORRESPONDING TO THE GOLDEN SECTION

Begin with the smallest rectangle. Adding a square to a golden rectangle produces another, larger golden rectangle. Now, add a square to the larger golden rectangle, producing another. As the figure shows, this process can be continued indefinitely. The rectangles trace out a logarithmic spiral.

Now look at any intermediate golden rectangle. The proportion of its longest side to its shortest is the golden section, k, so that if the short side is 1, the long side is k. Now add a square to produce another, larger golden rectangle. This one will have a long side of (k + 1) and a short side of k, with a proportion (k + 1):k = k, or (k + 1) = k^2. This again demonstrates the additive-proportionate nature of the golden section.

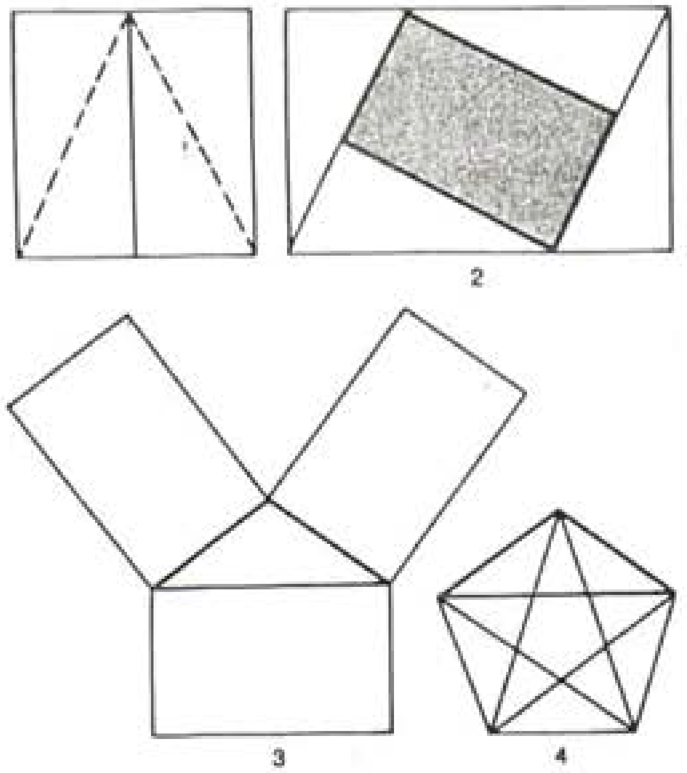


Figure 4d
CONSTRUCTION OF THE PENTAGON

The first step in this construction is to make a golden rectangle with the square. A golden rectangle is one in which the proportion of its long side to its shorter side is the golden section. Fold the square in half, and then fold the result along its diagonal. If you open the figure up again and cut along all the creases, you produce four right triangles. Arrange these triangles as shown in the second figure above and the result is that they form two golden rectangles, one on the inside of the figure and the other marked by its outside. Now with three golden rectangles, form a golden triangle as shown in the third figure. Five golden triangles make up a pentagon.

tions from rotation is illustrated in Figure 6. First, we generate a circle. Then, by folding the circle—another rotation—we generate a straight line, the diameter of the circle. At the same time we have defined the action of one half a complete rotation (180 degrees). Folding again determines a second diameter whose intersection with the first determines a point. Therefore, points are generated by rotations, points are not simple. The center-point requires three rotations for its determination. The two perpendicular diameters just created divide the circle into four equal arcs, defining a quarter-rotation (90 degrees) and also generating a square. A further folding operation (a 180-degree rotation) determines points dividing the circle into three equal arcs, defining an equilateral triangle. A somewhat more complicated sequence of rotations suffices to generate the pentagon (Figure 4 d). This construction of the pentagon proves that the golden section proportion is subsumed under the characteristics of rotation, provided that rotation is regarded as a process of generation. Furthermore, the rotation of a circle around one of its determined diameters generates a sphere, the primary solid. Additional steps lead to the five regular solids whose triangular, square, and pentagonal faces have already been constructed.

The procedure just sketched is known in modern times as synthetic geometry: Starting from a basic law of generation, we construct a series of constructions, using already accomplished constructions as "tools" for further constructions. All such further constructions "inherit" the fundamental characteristics of the generation process employed. Kepler insisted that only rotation qualifies as the basic action of generation in geometry. Indeed, there is no geometry without the circle, and no circle without rotation. On the other hand, as the Greek geometers, Nicholas of Cusa, Luca Pacioli, Kepler, and, later, Jacob Steiner showed, all of Euclid's geometry is derivable from rotation alone without recourse to axioms concerning straight lines and points.

"Wait a minute!" the skeptic says. "How can you claim that rotation generates the geometry of the discrete manifold? After all, how can you have rotation without some-

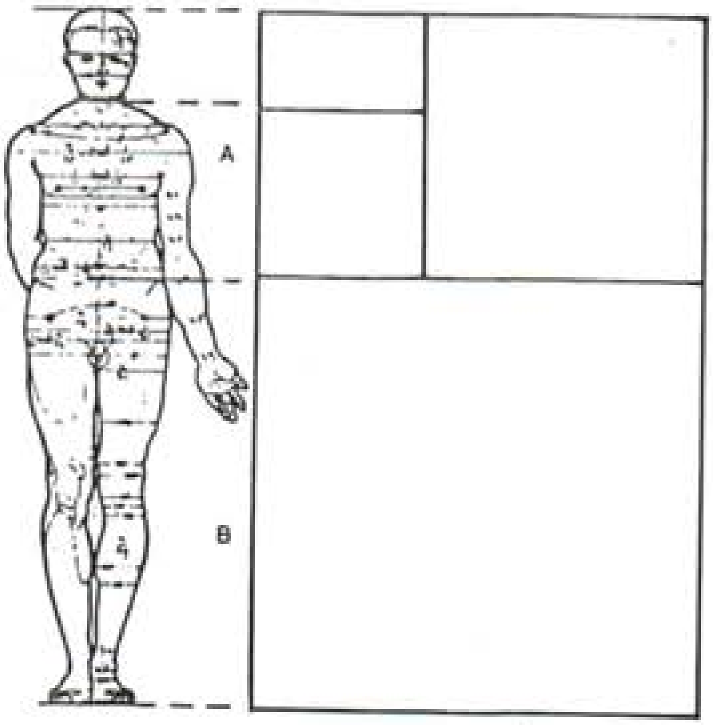
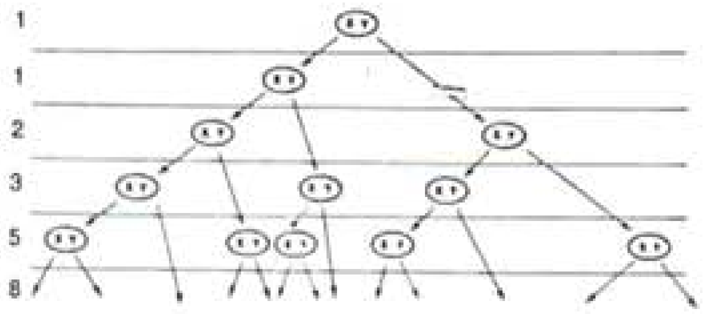


Figure 4e
THE HUMAN BODY AND THE GOLDEN SECTION
The divisions of the whole body by the navel, and of the part above the navel by the neck, are determined by the golden section.

thing that turns, without a center-point and without a space in which to rotate? Aha! You see, I have caught you in circular reasoning!"

Not really. It only appears that way, because you are accustomed to thinking of rotation in terms of motion of objects within the discrete manifold. Drop this image for a moment, and think instead of rotation from the standpoint of the isoperimetric theorem developed by the Greeks and redeveloped by Nicholas of Cusa (Figure 7). Imagine, first quite abstractly, any completed process. Such a process might be represented, abstractly, by a closed curve—a curve that returns to its starting-point (completion). Now, think of the area enclosed within the curve as representing the work completed by the process; we think of that interior surface as the total work (creation) generated by the process in the course of its completion. The efficiency of the process is the ratio of the enclosed area (useful work done) to the length of the closed curve (effort expended to do work).

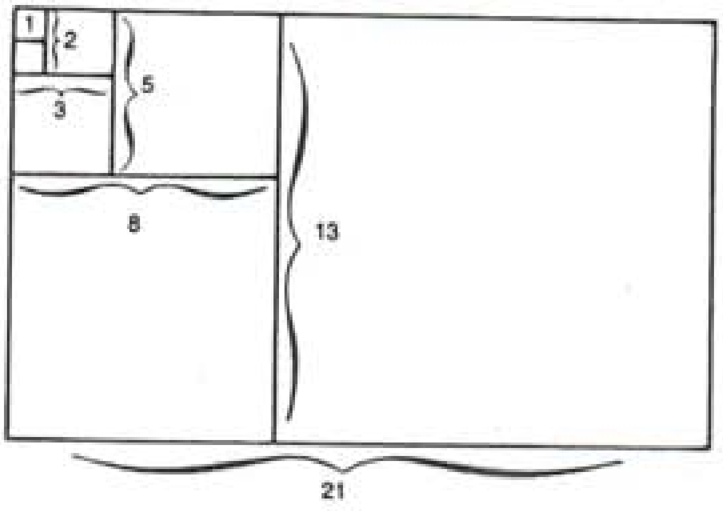
Under this representation, the most efficient process for a given quantity of effort expended is that represented by a circle; this is the statement of the isoperimetric theorem, which states that among all closed curves of a given length, the circle encloses the greatest area. True, the known proofs of the isoperimetric theorem seem at first sight to assume as given the determination of lengths and areas, of points and lines, and so on. However, a closer examination shows that rotation itself is the only self-evident assumption uti-



Generation	New Born Young	Dead	Total Number of Pairs
1	(1)	0	1
2	1	0	2
3	2	1	3
4	3	1	5
5	5	2	8
6	8	3	13

Figure 4f
GROWTH IN ACCORDANCE WITH THE FIBONACCI SERIES
In this simple case, the assumption is made that every pair (xy) lives for two generations and produces one pair of young during each generation. Each of these pairs lives for two generations and dies after producing the second pair of young. If, additionally, each pair of young consists of a male and female animal, which again produce two generations of young, then the growth of this animal population corresponds to the Fibonacci series.

In the Fibonacci rectangle, the proportions (short side to long side) of the ordered rectangles approach the proportion of the golden section.



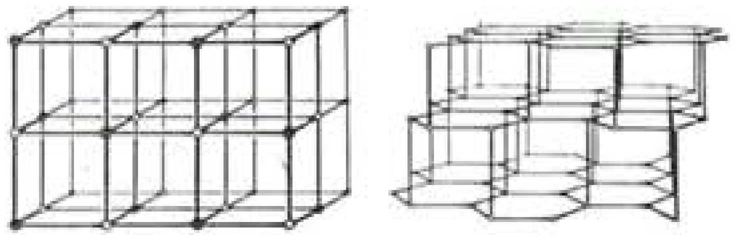


Figure 4g
TYPICAL INORGANIC CRYSTAL FORMS
Common salt crystal (left); carbon crystal, diamond.

lized. (As for length and area, it is only assumed that they are invariant under rotation; no numerical value need be assumed.)

Another way to state the isoperimetric theorem is to say that the circle corresponds to the *least action* required to generate a singularity (the enclosed area). What does this imply? Aha! It means that we can turn around and "re-create" the visual space of the discrete manifold, starting only with the primitive notion of a completed, least action process as the definition of "rotation." We "rebuild" the geometry of space relativistically; that is, everything is defined exclusively by what is imposed by the least action process itself, working the isoperimetric proof "backwards."

The reader at this point will probably have noted, perhaps not without a certain amount of apprehension, that we have entered a new, unfamiliar realm of thinking. We are defining space entirely in terms of processes, completely reversing the usual procedure of defining processes in terms of space and moving objectlike images. We are doing the analogue in geometry of what the great ancient Sanskrit scholar Panini developed as the origin of literate language: Panini claimed that Sanskrit, in particular, developed exclusively from verbs as the fundamental building-blocks of language. So, Panini derives the nouns from the verbs, rather than verbs as relationships between nouns, as today's cultural bias would dictate.

Imagine a totally formless void—it has no points, no dimension, no up or down, no differentiation whatsoever. This void is not even a space; it is only potentiality.

Now let our primary rotation act upon this void. A singularity is created—the primary area—which so far has no measurable extent or parts whatsoever. Someone looking into the void might "see" this primary area as an irregular, twisted surface with bumps. From inside the now transformed void, however, as measured "relativistically" by the primary rotation itself, the primary area is perfectly symmetrical—it has no bumps or other differentiations since none is definable by least action (least action defines only one singularity, the primary area itself). Next, let the primary rotation act upon the void once again, this time "folding the primary area in half." A new singularity emerges, that which we before identified as the "diameter" of the circle, a straight line. Now, we have a primary diameter defined as the result of two successive primary rotations. Someone might ask: "But isn't there an arbitrary choice here? What determines which of the infinitely many diameters is determined as the primary diameter?" The answer: There is only one primary diameter, because until some orientation is imposed by action upon the formless void, all diameters are the same. Once the primary diameter has been generated, an orientation exists in the void, against which further constructions can be "measured." So, the creation of space continues.

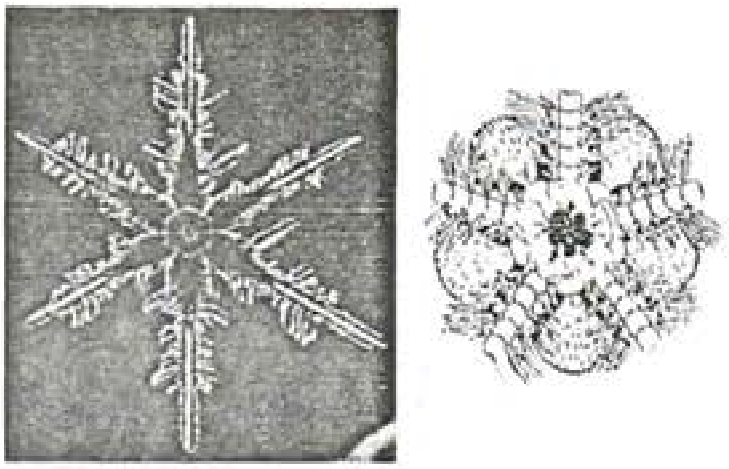
The reader may find this imaginary construction intolerably abstract. From the standpoint of the ontological transfinite, on the contrary, we are doing something very concrete: We are developing the means of thinking about the process of creation, self-reflexively, in terms of creation itself.

We have put aside the realm of mere appearences and are attempting to conceptualize the underlying reality of the Universe, the domain of negentropic process known as the "continuous manifold."

Riemannian Geometry

Anyone who thinks he can learn anything of fundamental importance from textbooks is a fool. Original contributions to science have invariably been made by insolent fellows who scorned textbook knowledge and concentrated on fundamental questions of method. Such insolent fellows generally educate themselves by studying the writings of the most hubristic of their predecessors, with an eye not to what their predecessors thought, but *how* they thought.

So it is for the question of the ontological transfinite. There is not a textbook on Earth that can teach you anything of significance about the "continuous manifold." Surely, the latter was the main preoccupation of the greatest mathematical physicists of the last 200 years, particularly Karl Gauss, Bernhard Riemann, and Georg Cantor. But, although you will find the names of these men throughout any mathematical physics textbook—Gaussian curvature,



Hexagonal symmetry of a snow flake

Pentagonal symmetry of an actinozoa organism

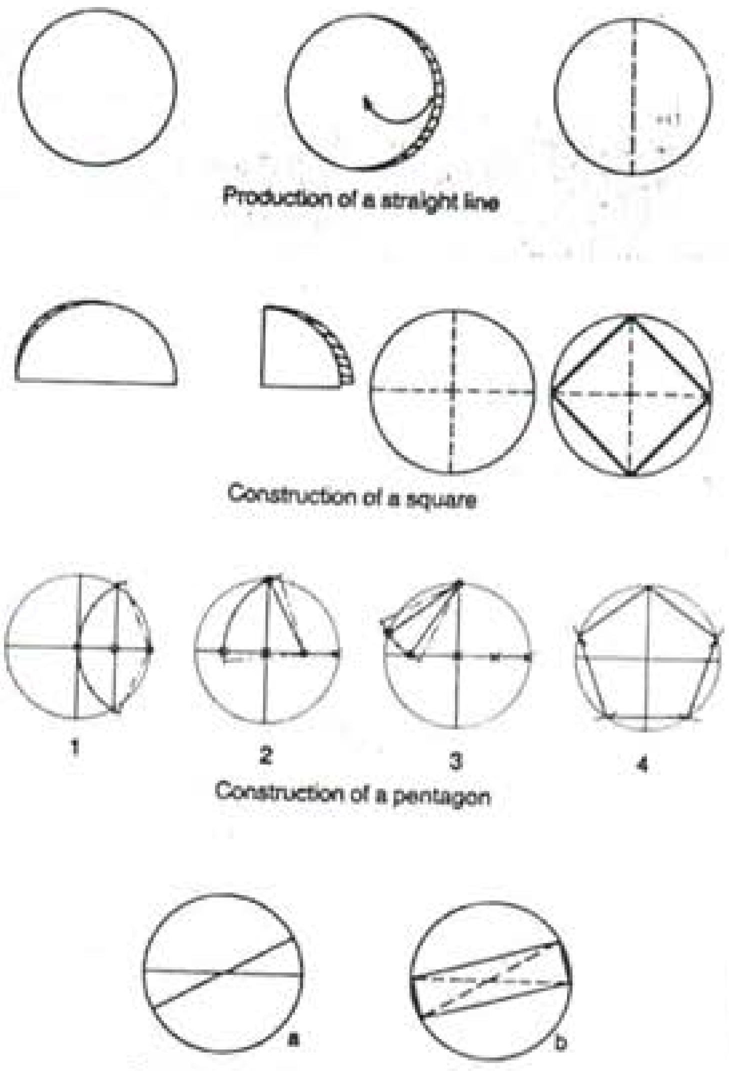
Figure 5
SYMMETRY IN ORGANIC AND INORGANIC LIFE

Gaussian distribution, Riemann integral, Riemannian manifold, Riemann mapping theorem, the Cantor set, and so forth—you will find nothing, or next to nothing, about the essential ideas that led these scientists to their discoveries.

With insolent disregard for elaborated technical details—which tell us nothing anyway of fundamental importance—we shall now briefly examine Bernhard Riemann and Georg Cantor's 1854-1882 attack on the problem of the "continuous manifold." Looking from their vantage point backwards at the work of Karl Gauss, we shall thereby be advantaged to appreciate the significance of Gauss's contribution to the theory of conical functions. It is the conical functions, discussed in the last section of this article, that provide the most powerful means so far devised to conceptualize the "congruent" notions of ontological transfiniteness, negentropy, and the continuous manifold.

Bernhard Riemann is generally regarded by educated scientists as one of the great inventors and masters of the mathematical methods utilized until now in theoretical

Figure 6
ELEMENTARY GEOMETRY CONSTRUCTION FROM THE CIRCLE BY FOLDING (ROTATION)



Production of a straight line

Construction of a square

Construction of a pentagon

Construction of a point (a) and a rectangle (b)

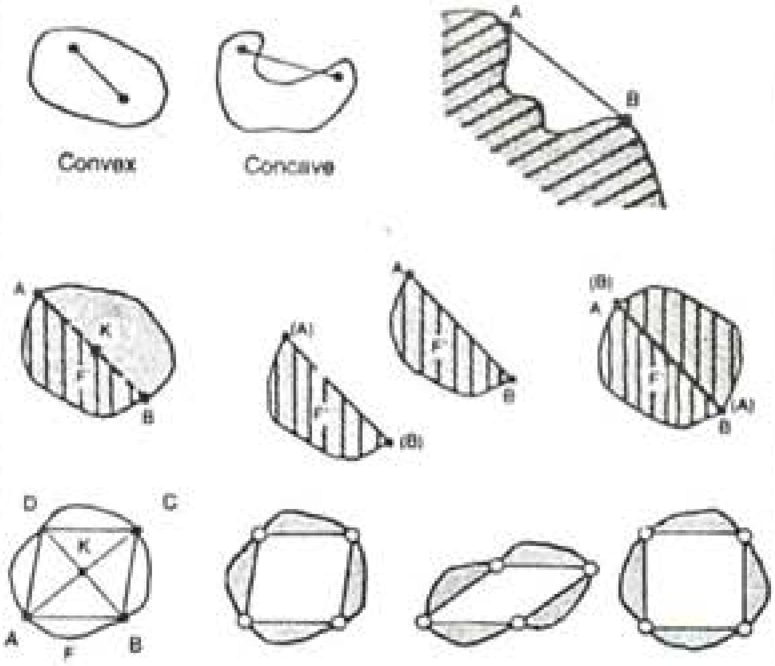


Figure 7
THE ISOPERIMETRIC PROPERTY OF THE CIRCLE

Jacob Steiner demonstrated, without use of any algebraic axioms, that the circle is that figure which encompasses a maximum area for a given perimeter. If it is assumed that another figure has been discovered that has this property, then this must at least be convex, for otherwise a connecting line could always be drawn from A to B that increases the area of the figure and decreases the perimeter.

Take an arbitrary figure. The first step—if it is concave—is to transform it into a convex figure by wrapping a string around the figure. This increases the area by the amount shown but decreases the perimeter. Therefore, the last step here is to expand the figure by a continuous amount along its entire edge to bring the perimeter back to its original length.

The second step is to make the figure symmetrical. To do this, divide the perimeter into two parts of equal length, AB and BA (for example, by measuring the perimeter with a string and then folding the string in half). Then the figure can be divided along the straight line that joins A and B. Choose the larger of two halves. Cut the other half out and rotate the chosen half 180 degrees from A to B. Then a symmetrical figure is produced with the perimeter of the original figure and possibly with a greater area. If the new figure is no longer convex, it can be made so by application of the first step.

Next, fold the resulting figure in half twice (as in the illustration) creating the points A, B, C, and D. Join them with straight lines. They will form either a square, or a rhombus parallelogram as shown. If it is a square, we are finished and have transformed the figure into a circle. If it is a rhombus, then the area of the figure can be increased by "straightening" the rhombus into a square, while the the perimeter does not change.

If this procedure is repeated, then the figure will get closer and closer to a circle. The circle is the only figure whose area cannot be increased in this way.

physics. As a matter of fact, Riemann's more significant contribution was to prove that these standard mathematical methods don't work!

The crucial experiment involved was reported by Riemann in an 1859 paper titled "On the Propagation of Plane Air Waves of Finite Amplitude." To a first approximation, an ordinary sinusoidal sound wave propagates with unchanged form thorugh the air. Under certain conditions, however, an intense sinusoidal air wave will change its form as it moves, transforming itself into what Riemann called a *Verdichtungsstoff,* a shock front across which a discontinuous change of pressure occurs (Figure 8). This is essentially the same as the familiar sonic boom caused by supersonic aircraft. Up to the point of formation of the shock front, the propagation of the wave appears to be adequately described by the usual differential equations of hydrodynamics. At the formation of the shock front, however, the hydrodynamic equations break down—some of the parameters assume infinite values—and the further behavior of the wave becomes, from the standpoint of the earlier apparently valid equations, indeterminate. The process has assumed new characteristics; a singularity has been formed. The newly formed shock front behaves differently; it is able to do new things, to perform forms of physical work that the original wave could not.

Eureka! Riemann with his crucial experiment brought out a universal law of the continuous manifold: The underlying processes of the Universe have the potential to fundamentally change their characteristics of action through the mediation of singularities—what appear in the discrete, visible manifold as "individuals" (for example, a shock wave). At the same time new potentialities, or "degrees of freedom," are opened up for further transformations. The same law of the continuous manifold is revealed in the familiar phase changes in matter, such as the freezing of water, where the transformation from liquid to solid is accompanied by the appearance of a new singularity-type, the water crystal.

The breakdown of the standard hydrodynamical equations at the point of formation of Riemann's shock front is caused by no specific fault of these particular equations. Rather, the transformations of the continuous manifold constantly tend to "diagonalize" any fixed set of equations in a manner described by Georg Cantor.

If ordinary mathematical physics breaks down at all the really interesting points, what kind of mathematics must we then develop to help us master the continuous manifold?

Riemann showed the way to the required "mathematics of negentropy" in his 1854 essay "On the Hypotheses Upon Which Geometry Is Based." The general theory of higher-order manifolds, developed by Riemann in that paper, is generally viewed as the basis for Einstein's discovery, some 50 years later, of relativity theory. This is true, but Einstein and almost everybody else stupidly refused to recognize the most shocking, most revolutionary point in Riemann's essay: Throw away all geometrical axioms, insists Riemann, to anyone willing to listen; the only admissible basis for geometry is the process by which a manifold of order n is transformed into a manifold of order $n + 1$! The subject of geometry is not a point, nor a line, nor a surface, nor a solid, but the process of transformation from point, to line, to surface, to solid and so on (see Figure 9). That is, the proper subject of geometry is negentropy.

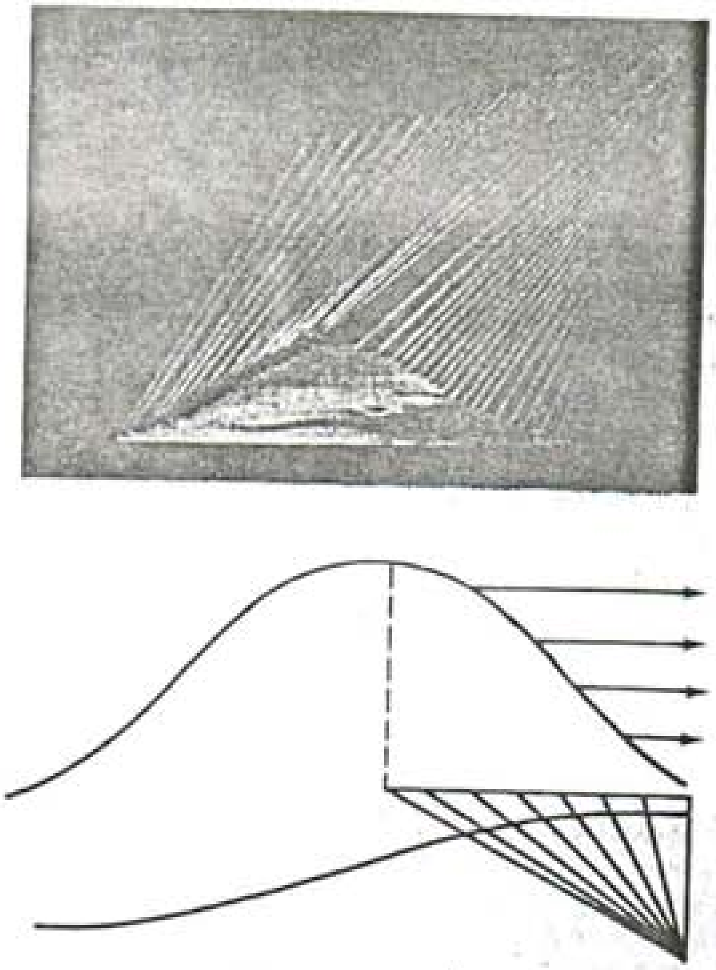


Figure 8
RIEMANNIAN SHOCK WAVES
The model and diagram show the production of an acoustical shock wave as Riemann had predicted in his 1859 paper.

Actually, Riemann's point was more than implicit in Wilhelm Gottfried Leibniz's creation of the infinitesimal calculus. Leibniz's chief point of departure was Pascal's study of the orders of generation of number-series. So, for example, we can regard the series 1, 2, 3, 4, 5, . . . as a series of the first order; 1, 4, 9, 16, 25, 36, . . . that is, the series of squares, as a series of the second order; and 1, 8, 27, 64, 125, . . . as a series of the third order. We can also consider Pascal's triangular array:

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1

as a series of growing, increasi

Now, look at the successive differences of the series terms as corresponding to the process of transformation from one term to the next

series: 1, 4, 9, 16, 25, 36, 49, 64, . . .
differences: 3, 5, 7, 9, 11, 13, 15, . . .

The derived series of differences 3, 5, 7, and so on, represents a changing process of transformation for the original series. Taking the differences of the derived series, you find

derived series: 3, 5, 7, 9, 11, 13, 15, . . .
differences: 2, 2, 2, 2, 2, 2, . . .

Thus, the derived series has an invariant law of transformation; each term is derived from the preceding by addition of 2. Now reversing the preceding derivation, we can reconstruct the original series by "integration"; that is, successive summation:

0, 0, 0, 0, 0, 0,
invariant law: 2, 2, 2, 2, 2, 2, 2, . . .
first "integral": 1, 3, 5, 7, 9, 11, 13, 15, . . .
second "integral": 0, 1, 4, 9, 16, 25, 36, 49, 64, . . .

Any victim of modern mathematical analysis courses should immediately recognize the origin of differential and integral calculus in the operation of formation of differences, and the reverse process of summation. However, the essential point has yet to be stated: Where do these series of numbers come from?

In science—as opposed to superstitious pastimes of "number magic" such as lotto or corrupt statisticians' concoctions of "economic indicators"—numbers arise from the counting of singularities. In fact, Pascal and Leibniz left no room for doubt on this question: their number series were intended to study the characteristics of negentropic processes, by counting singularities generated by processes of the type of Riemann's "n to $n + 1$" transformation of manifolds.

Figure 9 illustrates various simple examples of the geometrical origin of the Leibniz-Pascal difference series. As an elementary physical example, consider the growth of crystals through the addition of new layers of molecules while maintaining the same overall shape; the molecules are singularities of the growth process. Now what happens when a chemical change modifies the crystalline growth pattern of a substance? We have a transformation of the associated difference series. This is, implicitly, the method followed by Mendeleev in his discovery of the periodic system of elements.

The Fibonacci series and the series associated with a self-similar growing pentagon provide further, higher-order examples (Figure 4).

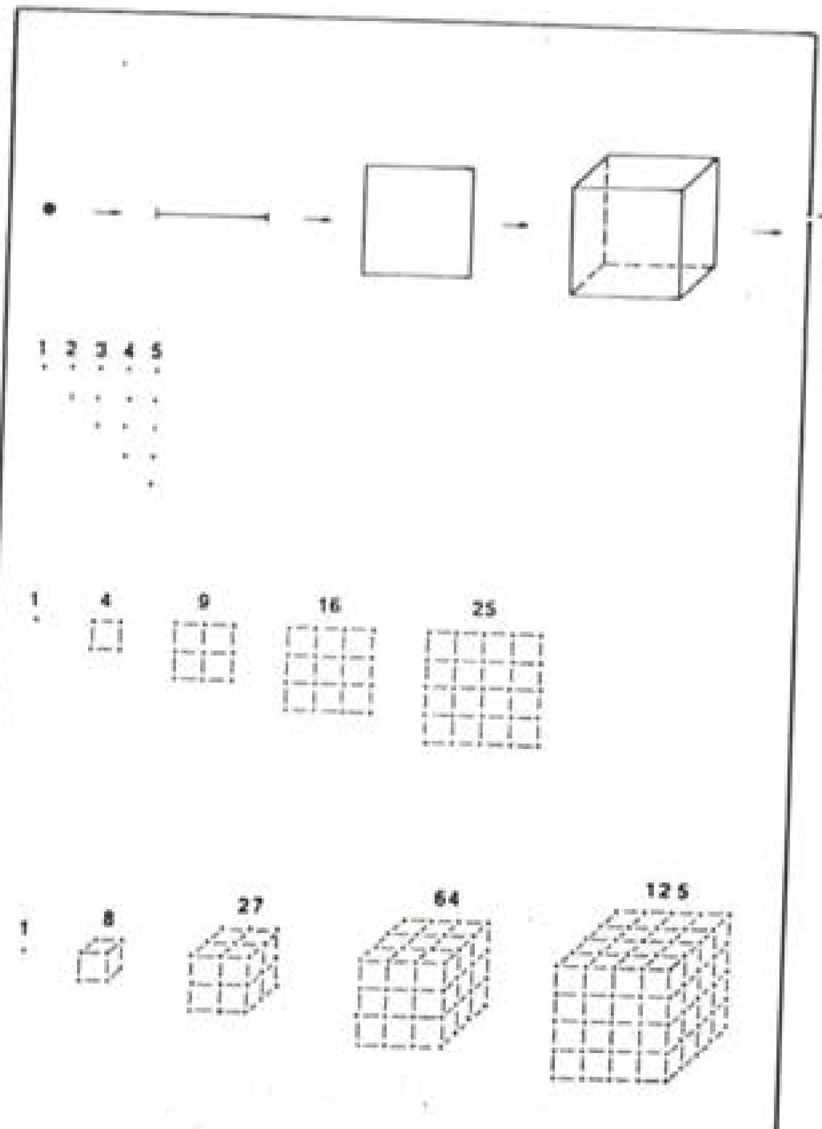


Figure 9
RIEMANNIAN TRANSFORMATIONS N TO N + 1

The Leibniz-Pascal work anticipates the principal question raised by Riemann in his "Hypotheses" paper: How do we measure negentropy? What is the metric in an expanding Riemannian manifold? All measurement, Riemann noted, involves the generation and counting of singularities—there is no "passive" measurement, no measurement without transformation. (If more physicists had read Riemann, fewer would have fallen for Niels Bohr and Werner Heisenberg's so-called epistemological paradox: the claim that because any measurement necessarily changes the process being measured, objective knowledge is therefore impossible.) On the contrary, we are delighted when we accomplish a change in a physical process—transforming the Universe is what science is all about! Scientific knowledge is knowledge bearing on the transformation of physical processes.

If the continuous manifold, in a given stage of development, is dominated by a series of process-singularities S_1, S_2, . . ., then any transformation of the continuous manifold, including the emergence of a new process-singularity, will be reflected in changes in the characteristics of action of S_1, S_2, . . in terms of the singularities they generate within the visible, discrete manifold; hence, ultimately in the difference series of numbers counting singularities in the discrete manifold. But, what happens between two successive terms in such a difference series? What happens in the interval during which no new visible singularities have yet appeared? The continuous manifold is in the act of evolving new characteristics of action, but the transformation is not completed—we don't "see" it yet, it is an infinitesimal relative to our metric. This is the origin and true meaning of Leibniz's "infinitesimal quantities" dx, ∂x, δx, and of the term "infinitesimal calculus."

Our revelation of the original significance of Leibniz's infinitesimals will probably send some professional mathematicians—and some others—into an apoplectic fit! The reason is, that during the early decades of the 19th century, the Jesuit August Cauchy undertook to destroy Leibniz's conceptions, by replacing the infinitesimals by a "theory of limits." In Cauchy's concoction, there is no generation of singularities, only the lifeless, banal continuity of the real number system, the supposed continuous process of a small real number becoming smaller and smaller until "in the limit" it becomes equal to zero. In mathematics education this takes the form of a pagan ritual, an act of supplication to the Buddha-like figure of August Cauchy known as "checking through an epsilon-delta proof." After performing this ritual for several years, the unfortunate victim of Cauchyism can no longer rid himself of the fanatical belief that the limit process of continuous convergence to zero is the ultimate reality of the Universe.

Nonsense! Cauchy's form of simple continuity has no counterpart in reality: The so-called real numbers should be renamed "artificial" numbers. The only numbers deserving the name "real" are the counting numbers, which count singularities, and the complex numbers corresponding to the elementary negentropic functions, which we shall introduce shortly in the section on conical functions.

In the context of Leibniz's true infinitesimals, the mystery surrounding the famous "quantum of action" disappears. Strictly speaking, there is no such thing as one half of a singularity! There is only one, two, three, and so on, singularities. The generation of identifiable individuals—as processes, or the objectlike "shadow"-images of processes in the discrete manifold—is just that: generation of whole, completed individuals. A rotation of 180 degrees does not enclose one-half of a circle; it encloses nothing. Contrary to statistical fictions, it is not possible to employ one-third of a worker, or to generate power from three-fourths of a nuclear power plant. What happens when a living cell divides? When can we say that there are two cells, rather than one? Obviously, only when we can count two complete, functioning, living cells.

There is only one condition under which it is permissible, by a figure of speech, to associate fractional, noninteger numbers to the ongoing generation of a singularity: that is, when the process of completion of generation of the singularity is mediated by the generation of countable lower-order singularities, thereby "dividing" the original action of creation. So, the growth of an organism is mediated by the division of its cells. But, beyond the finest available division of singularities in the continuous manifold, there can only be a "jump" from one term of a number series to the next: the corresponding, least division of action in the quantum of action.

Cantor's Transfinite and the Curvature of the Universe

Had Albert Einstein been confronted with the full implications of Riemannian geometry, it would have—to use the now proverbial expression—"blown his mind." By the time Einstein entered the university, the operations of Helmholtz and others had largely succeeded in obliterating all traces of the ontological transfinite from the teaching and practice of theoretical physics.

Riemann's methodological ideas might have been completely lost had it not been for the work of Riemann's student Georg Cantor. Cantor elaborated exactly those aspects of Riemann's work that were most hated and feared by the Jesuits, by the Viennese, and by British philosophical barbarians such as Bertrand Russell. Therefore, Cantor was subjected to one of the most intense campaigns of slander, isolation, and abuse in the history of science. Bertrand Russell, for example, took large amounts of time from his busy schedule of evildoing to try to bury and distort Cantor's work. So was born the monumental 1901 *Principia Mathematica* of Russell and Whitehead, a book on mathematical logic that set the stage for the disastrous "new math" and "set theory" brainwashing imposed on millions of schoolchildren after the 1960s educational reforms. Russell wished to ensure that no one even capable of comprehending the ontological transfinite could ever emerge from the world's school systems.

Fortunately, these operations were not entirely successful—otherwise you would not be reading this article right now. Cantor's ideas continued in the work of the late Professor Kurt Gödel, who, in his famous 1931 "Incompleteness Theorem," demolished the attempts of the positivists to deny the transfinite quality of the human mind and equate mathematics with a formal-logical lattice structure. Unfortunately, a proper understanding of Gödel's work and its implications remained restricted to a very small circle among his students, owing in part to the circumstance that the ruling positivists, refusing to acknowledge that they had been demolished, continued to preach the identity of the human mind with a large digital computer.

In the 1950s, the American economist Lyndon H. LaRouche, Jr. rediscovered the broader significance of the Riemann-Cantor work, while attempting to refute the Wiener-Shannon "information theory" approach to human intelligence and find a mathematical apparatus capable of describing the effect of technological revolutions on an economy. Realizing the implications of Riemann-Cantor for mathematical physics, LaRouche later set in motion an international science project directed at reviving the Riemann-Cantor method of the "ontological transfinite" in mathematical physics around the concrete tasks of mastering the plasma physics of controlled nuclear fusion, relativistic beam physics, and the process of life and aging. The work embodied in this article grew out of LaRouche's efforts.

Cantor's work is crucial because it explodes any attempt to submerge Riemannian geometry in the tiny, flat world of algebraic formalism. In particular, no one who understands Cantor can possibly fall for the commonplace characterization of Riemann's geometry as a mere generalization of Euclidean geometry to the case of more than three dimensions.

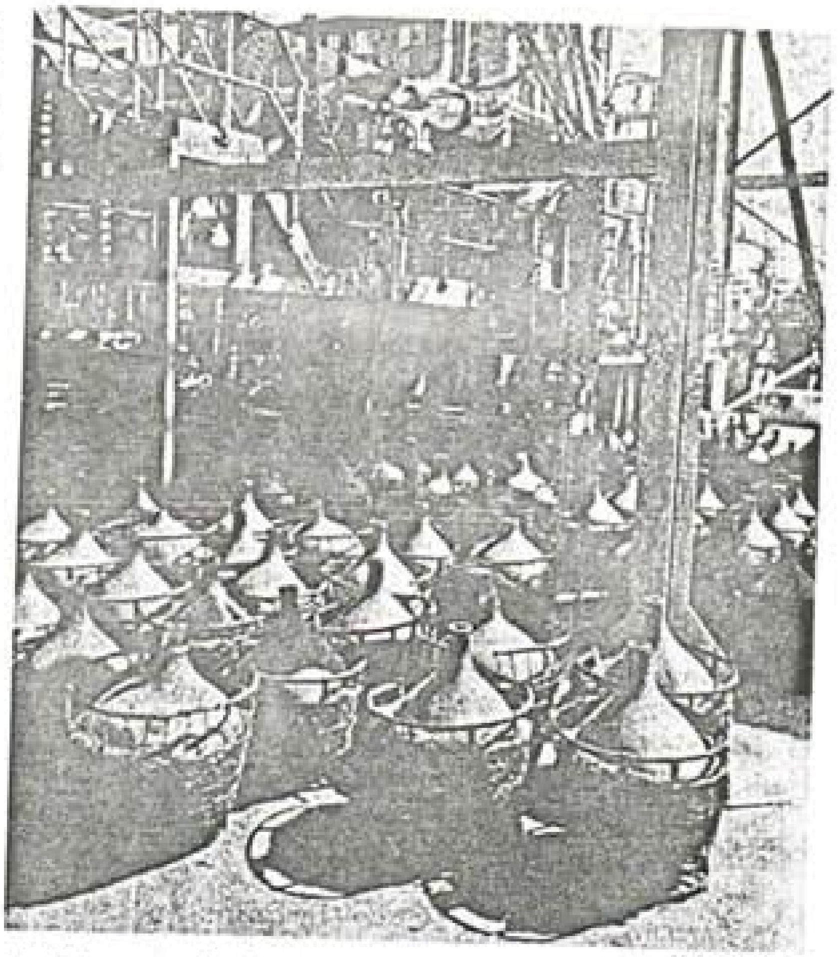
The first crucial point is that a single process-singularity may subsume a potentially infinite series of lower-order singularities. This is illustrated by the geometrical difference series and by the golden mean pentagon generation of infinitely extendable self-similar series. It is already implied by the fact that the circle, considered from the standpoint of rotation, subsumes an infinite series of polygons, in particular the polygons of 4, 8, 16, 32, . . . sides obtained from the circle by successive foldings. Cantor called this kind of singularity an actual infinite.

The second point is that in the Riemannian transformation N to $N + 1$, the number N is not an ordinary whole number counting objects or even mathematical dimensions, but is what Cantor called a transfinite ordinal, a number defining an order of singularities. Recall the Leibnizian difference series corresponding to growing line segments, growing squares and growing cubes (Figure 9). The first series we assigned the ordinal "1," the second "2," and the third "3." Each successive growth process corresponds to a faster rate of growth in the difference series. Now, consider the entire array of difference series of order 1, 2, 3, and so on:

x: 1, 2, 3, 4, 5, 6, . . .
x^2: 1, 4, 9, 16, 25, 36, . . .
x^3: 1, 8, 27, 64, 125, 218, . . .
x^4: 1, 16, 81, 256, 625, 1308, . . .
. . .
. . .

All of these series belong to a class or order of singularities defined by a geometric process of expansion; denote this order of process-singularities by N. Next, consider the column series 2, 4, 8, 16, 32, . . . ; 3, 9, 27, 81, ... These are exponential series, corresponding to simple exponential growth. Each of these series grows faster than any of the row series belonging to class N. Denote, therefore, the class of simple exponential series by $N + 1$. Finally, consider series such as the "diagonal" series 1, 4, 27, 256, . . . corresponding to the mathematical function x^x. This series grows faster than any of the series of order N, and faster than any of the simple exponential series (order $N + 1$). Denote the order of these diagonal series by $N + 2$. Now think about the implications of the transformations $N \rightarrow N + 1 \rightarrow N + 2$. Think about how an entire series of orders of singularities N, $N + 1$, $N + 2$, $N + 3$, . . . might be subsumed within a "super" ordering principle M, and how the preceding consideration of diagonals and columns might generate new orders of orders, $M + 1$, $M + 2$, and so forth. Finally, consider the highest, invariant principle which continually leads beyond any order of singularity to higher orders. Now you have some notion of Cantor's idea of the transfinite. Is this a mere abstraction? Is Cantor's transfinite just a fantastical construct fluttering around in our heads? Is it a mere mathematical tool for solving equations? No! The Universe itself is ordered this way.

Decisive proof of this is furnished, as LaRouche points out, by economic science: by the "great experiment" of man's physical existence by means of his productive activity within the Universe.


United Nations

Decisive proof of Cantor's transfinite is provided by the economic "great experiment": man's continued physical existence by means of his productive activity within the Universe. Here, a desalination research project in Kuwait, designed to supply fresh water for a growing population in a country that is oil-rich but water-short.

The basis of economic science is the observation that technological revolutions are necessary for the continued existence of the human species. Every "order" of technologies, developed by society at a given point of its existence, defines certain aspects of nature as "resources." Now, as a result of what might be described as the "curvature" of nature, or of the peculiar "curved" characteristics of man's relationship to nature (namely, that the rate of negentropy in a growing society exceeds that of the surrounding inorganic and organic nature), continued utilization of a fixed range of technologies eventually leads to a marginal exhaustion of resources. This manifests itself, prior to the actual physical disappearance of the resources in question, by a rise in the social costs of mining or equivalent activities required to access the resources. Therefore, unless new technologies are created, opening up a new resource base for the economy, society would "run down" and eventually collapse in mass starvation and disease. How do we get these necessary new technologies?—through the progress of science.

The progress of scientific knowledge occurs in successive sets of "higher hypotheses"—fundamental breakthroughs, in which preceding more or less axiomatic assumptions are overthrown in favor of better, more correct assumptions. Thus, fundamental progress occurs as a sequence of mutually contradictory sets of hypotheses.

After the discovery of a new set of higher hypotheses, a scientific and technological revolution occurs. There is a more or less vast elaboration of "simple hypotheses": discoveries and improvements in practice based axiomatically

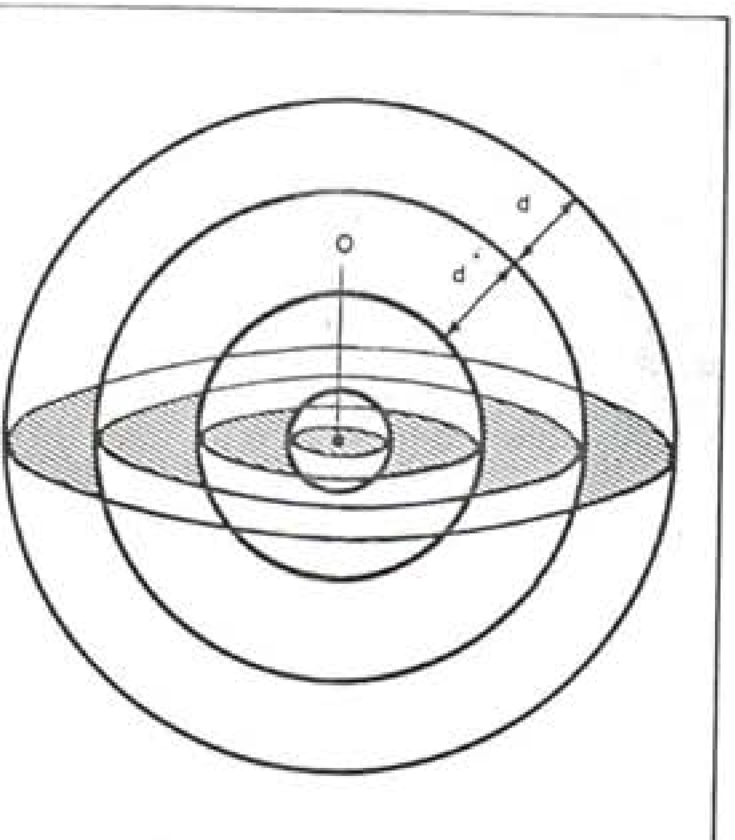


Figure 10
THE GAUSS-OLBERS PARADOX

The Gauss-Olbers Paradox is a proof that the universe is finite in mere extent. It demonstrates that if the universe were infinite, the night sky would not be dark but of infinite, blinding intensity. To the believers in an infinitely expanding universe created from a "big bang," this proof is "paradoxical"; in other words, they refuse to accept it.

The amount of light reaching an observer on the Earth from any direction is dependent on the number of stars in that general direction. If you first assume that the average density of stars in space is constant, then if the universe is infinite in extent, there will be an infinite number of stars in any direction from any point on the Earth. Therefore, an infinite amount of light will strike the Earth from any direction so that the night sky will never be black.

Divide space into a series of concentric spherical shells about the Earth, going outwards. The number of stars contained in one shell of radius R and thickness d will be approximately proportionate to the volume of the shell. Imagine that from the Earth outwards space is filled with such concentric shells, with continually increasing radii, always of thickness d; the observer is at their common midpoint O. The volumes of a shell with radius R is proportional to the surface of the sphere with radius R multiplied by the thickness of the dome, d. Since the surface grows with the square of R, the shell volume—and thus the number of stars in the dome—grows proportionally to $d \times R^2$*,*

The energy density of the light that reaches point O from a star of distance R decreases with the square of the distance, thus $1/R^2$*. The total energy density that the stars in a dome with radius R produce at point O is thus in the order of magnitude of*

$$(\text{number of stars in the dome}) \times 1/R^2 = (d \times R^2) \times 1/R^2 = d.$$

Thus, for greater values of R, each additional shell makes approximately the same contribution to the energy density observed at O. If we add the contributions of an infinite series of shells, then we will have an energy density at O of infinite value.

on the assumptions of the new higher hypotheses. (We might think of the last 50 years of development of the automobile as a paradigm for "simple hypothesis".) Textbooks are written, educational programs reformed, new industries called into life, and so forth. As a result, society takes a leap forward in productivity.

But, although the hierarchical elaboration of simple hypotheses might theoretically go on forever, society cannot continue to exist in this way. For, although simple hypotheses may lead to improvements in the existing range of technologies—for example, the modern car as compared to Ford's Model T—mere elaboration of knowledge leads eventually to technological stagnation, and via stagnation to collapse under the pressure of marginal exhaustion of resources. Hence, the continued existence of mankind requires an unending series of scientific-technological revolutions, based on overthrowing existing accumulations of simple hypotheses and introducing new, higher hypotheses—higher orders of knowledge. Now, think through what has just been said from the standpoint of Cantor's transfinite. The history of progress in scientific hypothesis, the history of technological progress, and the history of society in periods of scientific-technological progress, are all ordered in the same "transfinite" manner. Cantor's invariant principle of transfinite generation corresponds exactly to Plato's "hypothesis of the higher hypothesis," the principle of human creative discovery by means of which the ordered series of successive higher hypotheses for continued human existence is generated.

If human progress is ordered according to the transfinite, then what about the Universe as a whole? What does the existence and transfinite development of man within the Universe tell us about the form of the Universe itself? Kepler's proof already gives us the beginning of the answer. But we can go a step further, and demonstrate a most provovative thesis: Man's "transfinite" activity will eventually lead him to transform the Universe itself, to change the laws of the Universe.

Conical Functions

Up to the recent period, man's productive activities have basically imitated nature. Man has identified, reorganized, assembled, and ordered into networks of production, fundamental physical processes that do occur elsewhere—on other planets, in stars, and in those portions of the biosphere not controlled by man. However, this need not remain the case.

We must assume that our solar system, our entire galaxy, and so forth, are all developing, "producing" a kind of development that is beneficial to the rest of the Universe.

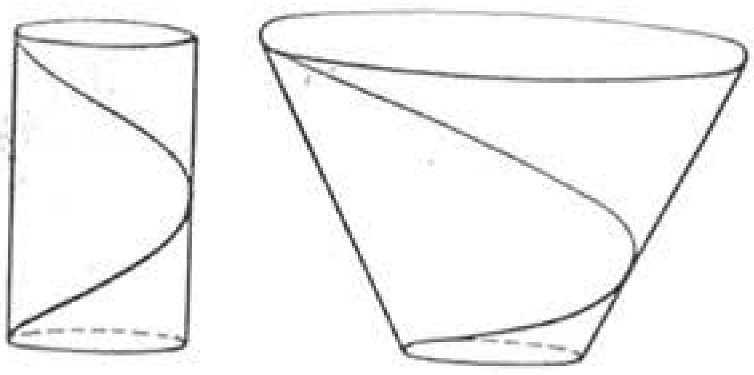


Figure 11

CYLINDRICAL WORK AND NEGENTROPIC WORK

A helix on a cylinder (left) represents the virtual work of a system, that required to keep the system operating, without producing any free energy or accomplishing net work. The ratio between the circular area that the spiral sweeps out and its rate of rise (or, work per unit energy) is constant.

A self-similar spiral on a cone (right) represents the production of net work The ratio between the circular area that the spiral sweeps out and its rate of rise increases. Net work is accomplished by a combination of rotation and extension.

With the emergence of life and especially human activities on Earth, this seemingly slow, seemingly diffuse negentropic process of the Universe appears "locally" to have accelerated tremendously. Now, through the crash development of beam technologies and of nuclear fusion, man will soon command energy densities hundreds of times larger than those of any process found in our solar system, and perhaps even in our galaxy. Is it not possible that man's productive activity will one day generate a shock wave in the Universe, cause a singularity that will transform the characteristics of fundamental processes of nature?

Archimedes seemed to have this possibility in mind when he said, "give me a place to stand and I will move the world." Archimedes also implied, as Plato had already stated before in the *Timaeus,* that the creation of the Universe is not finished. In particular, in his brilliant treatise "The Sand Calculation," Archimedes claims by implication that the Universe is essentially finite—its development up to now can be measured by a very "large," but in principle specifiable number *N.* Cantor's transfinite numbers define more precisely the notion of "finiteness" implied by Archimedes' argument. Ostensibly, the subject of the "Sand Calculation" was to settle a long-standing controversy of Archimedes' time as to whether or not a specifiable upper bound could be given for the number of grains of sand that might fill the sphere of the fixed stars—whose radius Archimedes identifies with the orbit of the then-known other planet, Saturn. Today's scientific professionals, with their typically tiny minds, would for the most part dismiss Archimedes' proof as a triviality. They would thereby miss three essential points embedded in Archimedes' method, which touch on the most fundamental scientific questions concerning the Universe:

(1) The measurability of the macrosphere (the sphere of the fixed stars) by the microsphere (the grain of sand), of the largest (then specifiable) singularity in visible space by the smallest singularity, means not only that the Universe is in some sense bounded in the large and in the small. It implies further a connection, a coherence between the finest and largest divisions in the Universe.

(2) The possibility of specifying a number far beyond anything that could ever be in practice reached by simple, one-by-one counting of objects depends on the construction of self-similar, exponential series of orders of magnitude. Archimedes' construction anticipates not only the modern decimal system of number-notation (based on the self-similar series 1, 10, 100, 1000, . . .) but also anticipates the modern physicist's use of orders of magnitude to specify characteristic length scales for physical processes. The fact that the Universe indeed manifests such self-similar series of characteristic scale-lengths implies that the generation of such series for number-notation coheres with the underlying negentropic process of the Universe. As we shall see, the best expression of this is to say that least action in the Universe is self-similar spiral action.

(3) Archimedes had a serious reason for "collapsing" the Universe outside our solar system onto the "sphere of the fixed stars." A very simple observation demonstrates that contrary to the naive impression that visual space (and, therefore, for the naive, the Universe) is limitless, in fact the entire material Universe must be organized in a space-manifold essentially equivalent to a sphere of finite radius. The observation is known today as the Gauss-Olbers paradox, although it was almost certainly well known to Archimedes (Figure 10). In fact, the calculation required was made by Archimedes in the "Sand Calculation."

Do the following experiment. Look up at the sky on a clear night. What do you see? The sky is black. Now suppose that the Universe were really infinite, and that (there being then no reason to the contrary) there were an infinite number of stars, distributed roughly uniformly in all directions throughout infinite Euclidean space. On that assumption, one can easily calculate how much light would come from any direction to an observer looking up at the sky. The result of the calculation is astonishing: If the Universe were infinite in the same specified sense, then a uniform, blinding white light of infinite intensity would meet the observer from every direction. So, since the sky is not white but black, our Universe must be finite.

The other proofs of the finiteness of the Universe deserve brief mention at this point. One is implied by the simplicity of language, as language was understood by the tradition of the classical Sanskrit grammarian Panini. Although the number of words in literate language may have grown in the course of the development of civilization, nevertheless, the generation of new words out of verbal roots occurred according to a quite small finite number of language principles. Because, on the one hand, literate language has shown itself to be efficient in its development, to mediate man's increasing mastery over the Universe there must be some correspondence between the principles of language and the order of the process-singularities underlying the

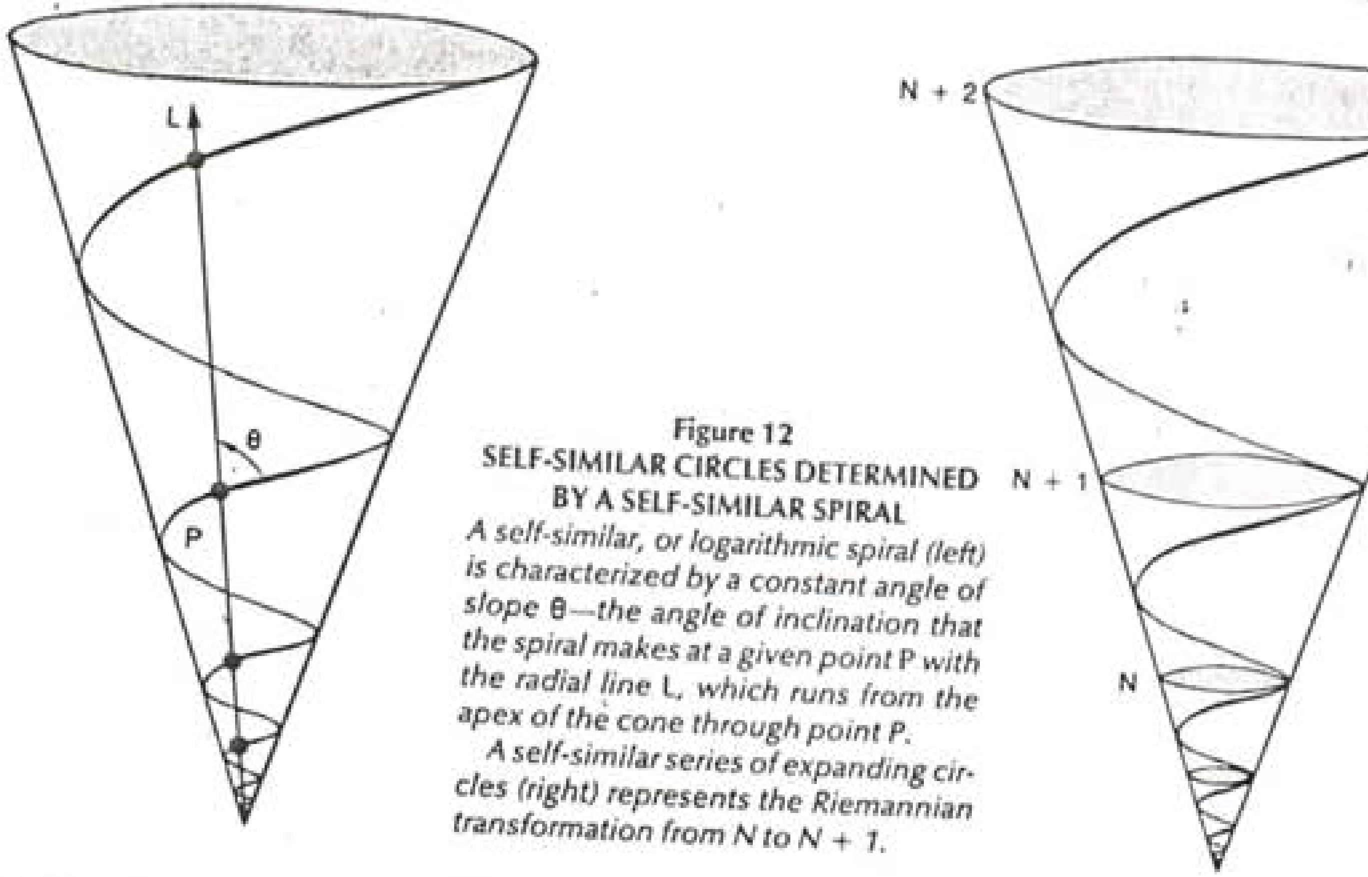


Figure 12
SELF-SIMILAR CIRCLES DETERMINED BY A SELF-SIMILAR SPIRAL
A self-similar, or logarithmic spiral (left) is characterized by a constant angle of slope θ—the angle of inclination that the spiral makes at a given point P with the radial line L, which runs from the apex of the cone through point P.

A self-similar series of expanding circles (right) represents the Riemannian transformation from N to N + 1.

measurable action of the Universe. The order of complexity of literate language, therefore, must be, in some sense, in correspondence with the "Archimedes number" *N* for the Universe.

The second proof, more familiar to physicists, is Planck's discovery of the least quantum of action. If we start with a given quantity of action, there is a limit to how finely that action can be divided, a smallest wavelength at which that action might be manifest as a simple, continuous electromagnetic wave. Were this not the case, we would have an "ultraviolet catastrophe" the equivalent in terms of wavelength to the Gauss-Olbers paradox for the amplitude of radiation in the Universe. Namely, if action were infinitely divisible in the Universe, we should expect initially red light to be transformed successively into shorter wavelengths—through the visible spectrum, from blue to ultraviolet, and from there into X-rays and gamma rays—like the water wave in a pond created by tossing in a stone, which breaks up upon reflection at the shore into smaller and smaller "wavelets." So, why do we see anything but high-energy gamma rays in the Universe? Because the Universe is finitely divided, not infinitely divided, in terms of action. In that sense, the Universe is finite.

Therefore, we must conclude with Plato and Archimedes that the Universe is finite, though growing and developing. Implicitly, this means that man might assist in accelerating or changing the direction of that development. But how?

Let us now consider action on the Universe. We return for that purpose to the previous discussion of creation in terms of rotational action on a formless potential void. That discussion was fine for the first steps of creation. But how must we think about a series of acts of creation, each acting on the entirety of previous creation to "adjoin" a new process-singularity? We must perform a geometric integration.

There are two cases to consider. Let us consider a circular area as representing the work done in creating the Universe so far, corresponding to a certain Archimedes number *N* of global degrees of freedom of negentropic action. First, we may consider the action required to maintain the Universe in its present form. There is one unique geometrical image corresponding to this situation: a cylinder with the given circular cross-section (Figure 11) and a helix on the cylinder. The helix represents continued, repeated rotation without additional work done. The volume contained between the circular sections in one rotation represents the "energy of the Universe"—the action required to maintain the Universe at its present state of development. The resulting circular section at the end of a rotation is identical to the original one—no new singularity. The simplest manifestation of this would be a sinusoidal wave. In a more complicated Universe, the appearances might look quite different, but basically things are just moving around, in an elaborate projection of what is ultimately equivalent to a sinusoidal wave.

How does action look in the Universe for this case? First, we have a global, process-singularity *S*, of order equal to the Archimedes number *N*, which subsumes all other existing or potentially generated singularities for the mode of existence of the Universe maintained by the cylindrical action in question. Second, we have a division of that global action in terms of nested chains of subsumed process-singularities, down to the least action which manifests itself in the discrete manifold. Such least action corresponds, as we saw at the end of the preceding section on Riemannian geometry, to a single, indivisible rotation-cycle in terms of

a Projection of elliptical cuts through the cylinder and cone

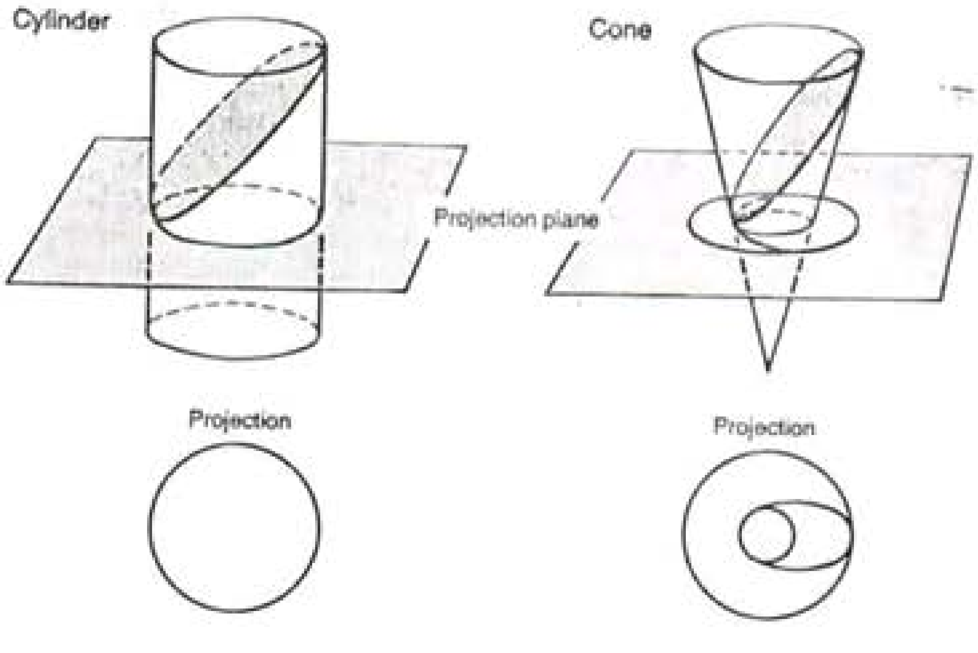


Figure 13
CONICAL VERSUS CYLINDRICAL ACTION

The shift from cylindrical to conical action produces a shift in the characteristics of action. The qualitative difference between cylindrical and conical action is seen in the projections of elliptical cuts through the cylinder and cone (a). The cut through the cylinder projects as a circle; that is, cylindrical action does not transform the universe. The conic section, however, projects as an ellipse, whose perihelion is the radius of the cone's circular cross-section at the base of the cut and whose aphelion is the radius of the circular cross-section at the top of the cut. The ellipse demonstrates the transformations produced by conical action.

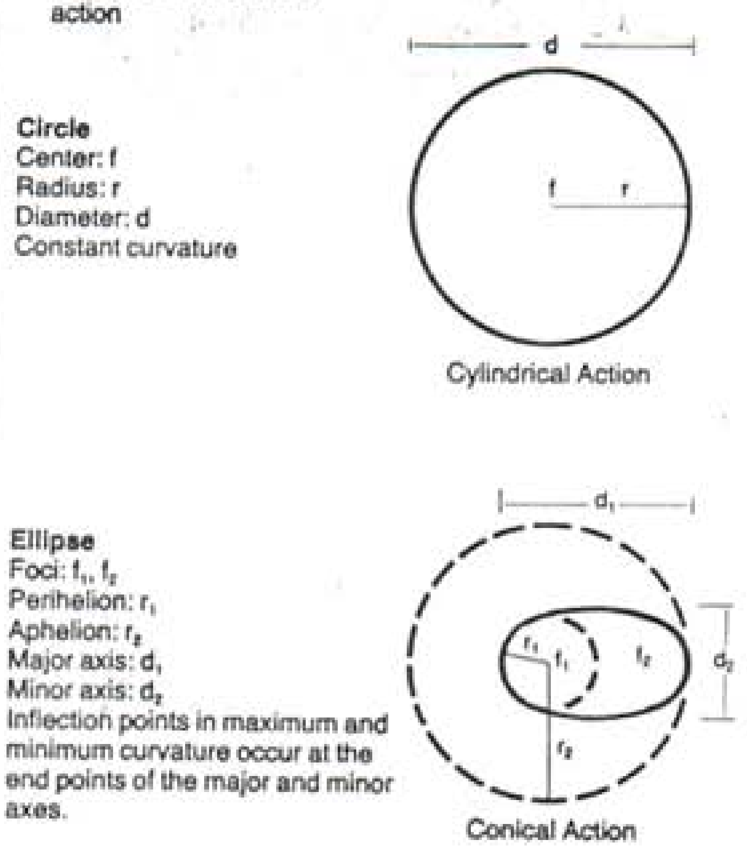
The shift from one to the other is characterized by a "splitting up" of every singular characteristic (singularity) of the circle (b): Its center goes over into two foci in the ellipse, its radius into perihelion and aphelion, the diameter into major and minor axes, and the constant curvature into maximum and minimum curvatures.

some lower-order process-singularity p. Hence, there must exist a finite number of process-singularities, $p_1, \ldots, p_n$—where n is the number of degrees of freedom—such that any division of action is equivalent—up to an unobservable fraction of the least quantum—to a combination of the form $p_1^{a_1} \ldots p_n^{a_n}$, $a_1, \ldots, a_n$ are counting numbers counting the number of rotation-cycles accomplished by the corresponding process-singularities. According to Archimedes' principle, there must be a lawful correspondence between the order N of the global-singularity S, the number of degrees of freedom n, and the maximum number of cycles of the microsingularities $p_1, \ldots, p_n$ which "fit into" a single cycle of cylindrical action for the whole Universe (corresponding to the minimum wavelength or maximum frequency attainable in division of a single global cycle of action). These relationships characterize the "laws of the Universe" in the given mode.

In actuality, the only hypothesis coherent with Kepler's proof is that, strictly speaking, no purely cylindrical action exists. What appears to be mere maintainance of the laws of the Universe as we observe them, is, in fact, a relatively slow rate of change of those laws, a slow rate of negentropy relative to the time scale of human observation.

Therefore, we must consider a second type of action: negentropic action of the Universe upon itself to generate a new, global process-singularity. There is one unique, simplest geometrical image corresponding to this form of action: rotation acting upon a circular area, to generate a larger circular area (Figure 11). This action generates a conical volume, as opposed to the cylindrical volume considered above; the lower circle represents the new singularity, and the conical volume is the work done to create the new singularity. Instead of the helix on the cylinder, we have a spiral, accomplishing a single turn around the cone in passing from the lower to the upper circle, and representing the negentropic action of combined rotation and expansion.

b Transformation produced by cylindrical and conical action



How, then, must we view a continuing series of negentropic action? In the simplest normalized case, we obviously have a cone with a series of circular sections proportioned in a self-similar series according to the golden mean (Figure 12). The apex-angle of the cone corresponds to the rate of negentropy, the ratio of work of creation of new singularities to the "maintenance-energy" of the Universe in a given mode. The continued negentropic action corresponds to a spiral making one turn of rotation between each set of circles. There is exactly one form of spiral that accomplishes this in a least action manner—the so-called self-similar spiral characterized by a constant angle of ascent to any radial line from the apex of the cone. (Any other type of spiral requires additional determinations, beyond the self-similar series of circles, to account for its deviation from an invariant law of ascent.)

Comparing this case to the previous, cylindrical case, we observe that conical action necessarily involves a shift in the characteristics of action in the Universe, as viewed in terms of existing process-singularities, even before the new global singularity emerges. This shift is most simply characterized by examining projections of a diagonal, elliptical cut between the upper and lower circles in the cylindrical and conical cases. The elliptical cut represents the characteristics of the volume generated by the rotational action in both cases. The projection of the elliptical cut onto the horizontal plane through the lower circle represents the characteristics of the action as viewed "within" the old Universe. We find that for cylindrical action, the projection of the diagonal ellipse is just a circle coinciding with the original lower circle.

For conical action, however, the projection is an elliptical orbit, whose perihelion coincides with the radius of the lower circle and whose aphelion corresponds with the radius of the upper circle. The creation of a new global singularity in conical action is reflected in the "splitting" of the unit-singularities of the circle into pairs of singularities for the ellipse.

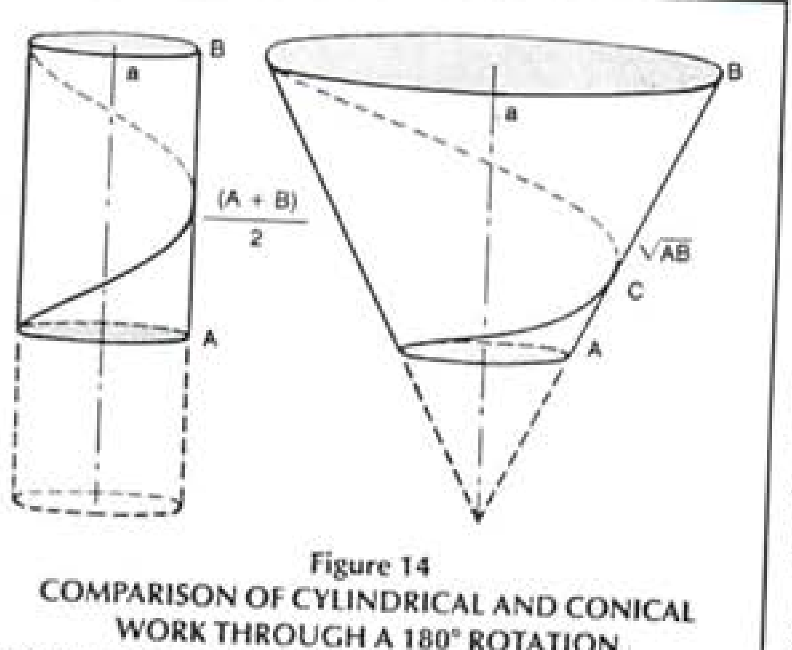


Figure 14
COMPARISON OF CYLINDRICAL AND CONICAL WORK THROUGH A 180° ROTATION
The magnitudes A, B, (A + B)/2, and $\sqrt{AB}$ correspond to the height, which is measured along the central axis a. Since the spiral at right is self-similar, the proportion of its height at A to its height at a half-rotation C is equal to the proportion of its height at C to its height at B, or

$$A:C = C:B, \; C = \sqrt{AB}.$$

Next, consider the nature of willful intervention to increase the rate of negentropy of the Universe.

Approximate the prevailing, relatively slow rate of negentropy by a cylindrical function of the type described above. To change the laws of the Universe, we must transform that cylindrical action into negentropic, conical action. These two forms of action afford us the rigorous distinction between mere *energy* (cylindrical action) and *work* (conical action). Our task is to induce that action that now appears as "energy of the Universe" to do work on the Universe, thereby increasing the energy of the Universe in the new mode. We thereby unmask the fraud of Helmholtz's "conservation of energy" principle, which is based on the completely arbitrary assertion that the Universe is not capable of doing work upon itself. On the contrary, if the aim of the Universe were to conserve energy, Helmholtz (and the rest of us) would not exist!

The paradigm for transformation of energy into work is Riemann's shock wave; in that sense, Riemann's 1859 paper is a crucial experiment proving that the "conservation of energy" thesis is false. A simple sinusoidal wave (corresponding to cylindrical action) is transformed in propagation through the medium (air in the acoustical case, the manifold of existing creation in the universal case), into a shock front, a new singularity, that modifies the characteristics of the medium. How does this occur? Riemann distinguishes between an initial wave of infinitesimal amplitude, which remains sinusoidal in propagation, and a wave of finite amplitude, in which an additional margin of action is present that modifies the condition of propagation even before the actual shock front is formed. It is this additional, negentropic quantum of action that has transformed a cylindrical process into a self-amplifying conical process.

Riemann implies, therefore, that the action of negentropic transformation of cylindrical into conical action may be divisible: It is not necessary to grab hold of the Universe and bend it by brute force to generate a new global singularity. It is instead possible, by intervening at a lower level of the process, by activating certain marginal transformations of action, to efficiently transform the characteristics of the Universe and induce the formation of a global "shock wave" as a causal consequence of those changed characteristics. A small amount of the right kind of work can set in motion an incomparably larger amount of work.

The decisive elements for a geometrical analysis of this kind of negentropic transformation were contributed by Karl Friedrich Gauss in his early work on the arithmetic-geometric mean and elliptic functions.

Compare cylindrical and conical action for a single cycle of action (Figure 14). In case this cycle is indivisible, that is, not mediated by lower-order singularities, the negentropic transformation required is an elementary quantum of negentropic action: We must simply directly create the new singularity to be generated by the conical function. In case the cycle is divisible, the first division possible for least

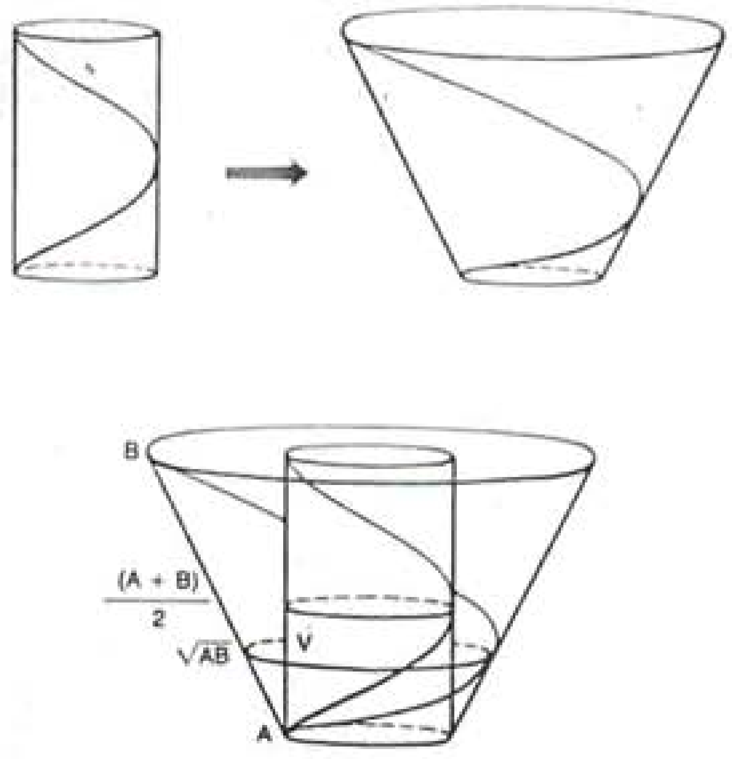


Figure 15
TRANSFORMATION OF CYLINDRICAL WORK INTO CONIC (NEGENTROPIC) WORK
The difference between the volume V of the cone and that of the cylinder represents the work that is produced through negentropic transformation.

action, as we saw in our discussion of the circle, is halving the action; that is, dividing one rotation of the helix or spiral into two half-rotations of 180 degrees.

In the latter case, the displacement from cylindrical to conical action already manifests itself with the creation of a characteristic singularity at the midway, 180-degree point of the rotation. Comparing the points along the vertical axis reached by the helix and spiral respectively, we see that the point reached by the first half-rotation of the spiral lies somewhat below that reached by the helix. Counting distance reached along the conical axis as line of reference with the lower and upper circles at heights A and B respectively, we find that the helix reaches the height $(A + B)/2$ after 180-degree rotation, while the spiral reaches the point $\sqrt{AB}$. The origin of the discrepancy is the characteristic acceleration of self-similar, negentropic action: While the helix progresses linearly upward at a constant rate, the spiral accelerates exponentially upward and outward as a function of the angle of rotation around the conical axis. In particular, the work done by the second half-rotation on the spiral is larger than the work done by the first half-rotation (Figure 15).

$(A + B)/2$ and $\sqrt{AB}$ were known to the Greek geometers as the arithmetic and geometric means, respectively, of A and B. As one can show, these same two means appear, up to a constant factor of proportionality (depending on the apex angle of the cone), as the major and minor axes of the ellipse obtained by projecting the diagonal cut on the cone onto the plane of the lower circle. Thus, the discrepancy between the arithmetic and geometric means is characteristic of the manifested shift in the characteristics of action in the Universe undergoing negentropic transformation.

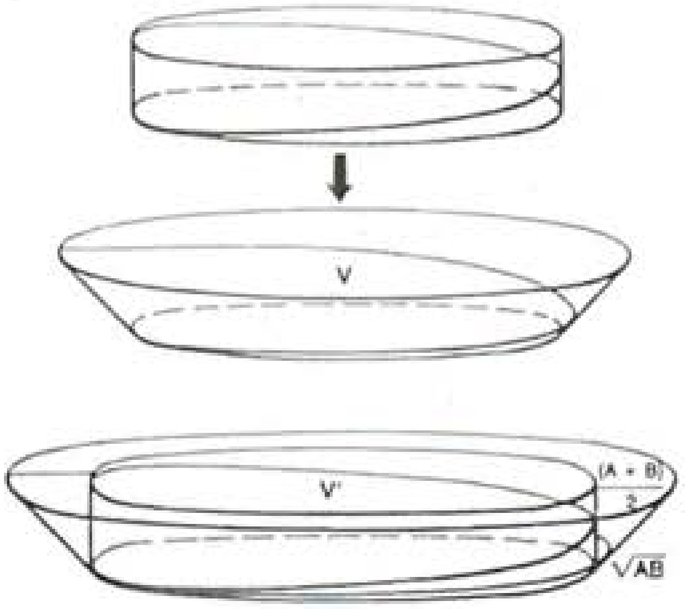


Figure 16
THE ARITHMETIC/GEOMETRIC MEAN AND NEGENTROPIC TRANSFORMATION
Two steps in the Gaussian "arithmetical-geometrical" chain of negentropic transformations. Production of a work volume V. The new work volume V' represents the work that is produced by the negentropic transformation of the second step.

Now, cut the cone by horizontal planes at the levels corresponding to the arithmetic and geometric means, the heights corresponding to the work done by the first 180-degree division of the cylindrical action and the first 180-degree division of the conical spiral action. These cuts define two circular sections of the cone, bounding a volume V that thereby corresponds to the displacement from cylindrical to conical action in terms of the midpoint of that action. Imagine a continuous deformation from the cylinder to the cone, keeping the heights of the original upper and lower circles fixed: As the helix deforms into a spiral, the halfway (180-degree) point shifts downward. Hence, the volume V represents work done in transforming cylindrical action into conical action. The "downward" direction of the displacement indicates that this work takes the form of a marginal portion of action "invested" to induce that transformation, and "paid back with profit" by the self-amplifying acceleration of conical action in the second half of the rotation.

Obviously, we now have a problem of exactly the same form as the original one: Either the negentropic transformation required to produce the work V is indivisible, or the same arithmetic-geometric mean process, applied now to the smaller cylindrical and conical sections, identifies an even smaller margin of action whose execution would efficiently cause the generation of V. The corresponding elliptical projections identify, implicitly, the lower-order singularities that must be acted upon to generate the negentropic transformation.

Continuing this process, we generate a chain of arithmetic-geometric means, up to the point where the original action cannot be more finely divided. By Archimedes' principle, that point is arrived at after a finite number of steps, corresponding to the degree of elaboration of the Universe up to the given point of action. The last, smallest transformation in the chain is the least quantum of negentropic action necessary to efficiently cause the Universe to generate the new singularity, as required. If we are able to perform that least quantum of work, a chain of negentropic transformations, corresponding to the arithmetic-geometric chain run in reverse, propagates through the continuous manifold, amplifying to the point of transforming the laws of the Universe. This is the process addressed by Riemann and his school by the concepts of "retarded potential" and the Dirichlet Principle, which describes how the introduction of a singularity forces a continuous manifold to transform its global geometry.

How much work must we do to accomplish this change? Must we change the orbit of a planet, or cause certain stars to oscillate in a certain manner? Or perhaps it will suffice, using the new relativistic beam technology under development, to generate a single, new type of "wave-particle." The preceding considerations, carried out at the level of the "hypothesis of the higher hypothesis" give us so far no concrete answer, but only a way of thinking about the problem. In fact, the method sketched here applies not only to changing the laws of the Universe, but to transforming any physical process, whether it concern the transformation of the climate of the Earth, the creation of new forms of living processes, or any other interesting and useful task of this sort.

When we consider how man might accomplish the least quantum of negentropic action to change the laws of the Universe, we measure the Universe by the productive activities of man. Indeed, as LaRouche argues, this is the only rigorous measure of the Universe that we possess: the measure of the relationship between man and nature elaborated by LaRouche in his definition of "potential relative population density." The continued existence of human civilization for the generations to come—whose assurance uniquely defines the moral purpose of our individual lives, the "good" in human practice—is only possible through continual increase in man's productive powers, measured as increases in the potential relative population density of the human species. At some point, we will necessarily change the laws of the Universe, to improve the Universe as a basis for continued human existence. Otherwise, if man becomes "bad" and refuses to do the necessary work, mankind will cease to exist.

What does this mean about the ultimate form of the lawfulness underlying nature? There are no fixed laws of the ordinary mathematical type, no tyranny of Helmholtzian physics. Rather, the lawfulness of the Universe is ultimately knowable to man as moral law, as the lawfulness that governs man's participation in the ongoing composition of the Universe: to be free to exist, we must be good.

Author Jonathan Tennenbaum demonstrates to a German FEF audience the use of the golden section in Renaissance art. The illustration is Raphael's "Marriage of the Virgin."

EPILOGUE

The Unfortunate Case of Ludwig Boltzmann

Thus we arrive at the end of our introductory, geometrical treatment of the ontological transfinite. In attempting to address merely the bare essentials of the matter, we have left out many important points, which the reader can profitably follow up.[1] In closing, however, we shall add one matter that connects the previous discussion to the threatened collapse of science and humanist culture today.

The preceding discussion of the ontological transfinite should properly raise the question: If this fundamental notion was understood by Bernhard Riemann and Georg Cantor a mere century ago, how is it that we find today's science (and our culture as a whole) almost totally ignorant on this point? Rather than attempt to give a comprehensive historical account of the process behind this remarkable case of collective amnesia, we shall elucidate the matter with a revealing special case—the conquest of mathematical physics by the statistical doctrines of Ludwig Boltzmann.

Following the ugly resurgence of oligarchism in Europe in the wake of the 1815 Treaty of Vienna, a vast campaign was mounted to crush the networks of continental science that had been built up by Gottfried Wilhelm Leibniz and his followers, from approximately 1667 on. The main instruments of this renewed Inquisition against science were the continental Jesuits and Dominicans on the one side, and the Jesuit-linked networks of Scottish Rite Freemasonry that ran the British Royal Society on the other. In France, the Jesuit-controlled Royalist August Cauchy acted effectively to destroy the remnants of France's leading scientific institution, the Ecole Polytechnique.

In Germany, however, the Leibnizian tradition was maintained into the middle of the 19th century, in spite of opposition, through the efforts of Gauss, Jacobi, Dirichlet, and the Humboldt brothers, in particular. These efforts, part of the general cultural renaissance of the Weimar Classical period, came to fruition in the production of generations of extraordinarily gifted scientists and engineers.

However, although German scientific excellence continued into the 20s of this century, the cumulative effect of Jesuit and Royal Society operations was to cause a shift in the *methodology* taught and practiced by leading German scientists, away from the ontological transfinite toward what might at best be termed the "methodological transfinite." After the suppression by Hermann Helmholtz and Leopold Kronecker of the ideas of Bernhard Riemann and Georg Cantor, scientists abandoned the concept of the Universe as a creative process. Instead, they saw development chiefly in the improvement of mathematical methods, by means of which an "asymptotic" approximation to the supposedly *fixed* Laws of the Universe might be achieved.

Without such a shift in methodological outlook, the scientific community would never have tolerated the frauds put out by Helmholtz and Lord Kelvin under the heading of the supposed universality of the Second Law of Thermodynamics. Helmholtz not only denied the developing nature of the Universe, but was dishonest enough even to assert that the opposite had been proven:

> . . .[I]f the Universe is abandoned to the undisturbed competition of its physical processes, the entire store of energy will finally be transformed into heat and all heat will arrive at equilibrium in temperature. Then every possibility of further change is used up, then a complete cessation of all natural processes of any possible kind must occur. . . . In short, from then on, the universe will be condemned to eternal rest.
>
> *On the Interaction of the Powers of Nature*, 1854

This is the famous "heat death" thesis, a piece of sophistical nonsense whose fallacy becomes immediately evident as soon as the implications of the ontological transfinite are understood.

Throughout the second half of the 19th century, the Berlin-centered "mafia" around Helmholtz and Kronecker succeeded in imposing one methodological fallacy after the other upon the prevailing practice of mathematical physics. The Göttingen-centered Leibnizian school (Gauss, Dirichlet, Wilhelm Weber, Riemann) was reduced to a minority tendency in the scientific community. Chief among these damaging fallacies was Helmholtz's elimination of the crucial distinction between "energy" and "work" in his treatment of the so-called principle of conservation of energy. A second, disastrous blow was dealt to the Göttingen school when Helmholtz succeeded in winning over the German physicists to James Clerk Maxwell's misleading formulation of electrodynamics—an axiomatic approach which Maxwell cooked up by rewriting the work of Gauss, Weber and Riemann while systematically eliminating their essential ideas. We can thank Helmholtz, because of this operation, for the epistemological horrors unleashed on physics by Niels Bohr et al. in the 1920s. The so-called wave-particle paradox exploited by Bohr to sell his insane "Copenhagen interpretation" of quantum mechanics had already been solved, in essence, by Dirichlet and Riemann in their 1830-1860 work on potential theory! The influence of Helmholtz, Maxwell, and others was so great that by the turn of the century, even those who, like Felix Klein, still read Riemann, failed to grasp the most important ideas in the earlier work. As a philosopher once said, "There are no secrets, only blindness."

By the last decades of the 19th century, the methodology of mathematical physics had so degenerated, that no one in Germany was capable of perverting it to a lower level. Therefore, the center of methodological discussion shifted to Vienna, whose rich heritage of cultural decadence provided the raw material for several generations of famous philosophers of science: Ernst Mach, Ludwig Boltzmann, Ludwig Wittgenstein, and the Vienna circle took up where Helmholtz left off.

Boltzmann attempted to prove that development in the Universe is a mere illusion—an appearance based on statistical effects among a vast assemblage of "elementary particles" interacting according to fixed laws. The fundamental laws of the Universe, according to Boltzmann, are the laws of chance—the laws that govern the assignment of odds in a poker game or gambling house. In Boltzmann's universe, we are nothing but swarms of billions of tiny particles fortunate enough to have been tossed together in a certain way.

Of course, this view is nothing but the atomism of Epicurus, propped up by the intervening development of two impressive mathematical apparatuses called "the theory of probability" and "analytical mechanics." In fact, Boltzmann's views would hardly have been taken seriously in the raw form just described. However, by an impressive exercise of mathematical virtuosity, Boltzmann was able to derive some of the already known empirical properties of heat—in particular, the apparently entropic process of equilibration of temperature differences by heat conduction—as logical consequences of his "molecular chaos" hypothesis. Thereby, he created the vast mathematical structure called "the statistical molecular theory of heat." So impressed were Boltzmann's contemporaries by the power of his equations, that many readily accepted the idea that the statistical theory applied not only to the dissipation of heat, but to every physical process in every corner of the Universe. After all, what else could there be in the Universe except lots of little particles?

For a late-19th-century Viennese thinker such as Boltzmann, however, there remained an essential difficulty. According to Boltzmann's statistics, the Universe must progress to more random states—just like a pack of cards initially arranged in order and then mixed up by shuffling into more and more random arrangements. This fit completely with Helmholtz's prediction of the "death of the Universe," its ultimate degeneration into an equilibrium state of maximum chaos. But, worried Boltzmann, if the amazing ordered processes observed in living processes, in crystals, and in the solar system exist today, that means the Universe must originally have been created in a highly ordered state. This idea offended Viennese cultural sensibilities, which preferred to assume that the world had been, was, and ever would be as decadent and degenerate as it was then. Therefore, Boltzmann was led to invent a novel "solution" to this difficulty, the "theory of fluctuations." According to this theory, the Universe is already "dead," already completely chaotic. However, in any random process, there are fluctuations by chance, in which ordered arrangements will "pop up" in the middle of chaos. So, for example, under the assumptions of probability theory, if every day you throw a die 100 times, then it will happen approximately once every 10^{75} years that the same number comes up on the die each of those 100 throws! If there are enough elementary particles in the Universe, and if you wait long enough, thought Boltzmann, then once in a while an island of order and coherence will emerge amid the chaos—a chance fluctuation doomed to dissolve and disappear again as soon as its good luck runs out. So, Boltzmann triumphantly concluded, our world must be such a fluctuation!

Alas! After having reached this pinnacle of scientific insight, Boltzmann himself began to "decay." He was beset by illness and deepening depression. Even some of his fellow Viennese were skeptical; the great Ernst Mach, for example, objected that he had never seen any of the tiny particles. Isolated and dejected, Boltzmann finally committed suicide. Indeed, what human identity could remain for someone convinced that his very existence was an accident?

Were we to take Boltzmann's ideas seriously, we must conclude that his death was a chance occurrence. In reality, it was a lawful consequence of the post-1866 abandonment of the ontological transfinite. From a rigorous scientific standpoint, the statistical mechanical theory of the Universe is pure insanity.

Today, nevertheless, physics professors all over the world receive large salaries for teaching exactly the statistical world view that drove Ludwig Boltzmann to suicide! If anything, today's "improved" statistical doctrines, typified by the work of Ilya Prigogine, are even more insane than the original version. In the 1920s, Max Born and Niels Bohr imposed "statistical interpretation" upon the work of Planck and Schrödinger. Bohr laid down the dogma that the interactions between Boltzmann's little particles—which in the meantime had been identified as electrons, photons, protons, and so forth—are *by nature* incapable of being described in any way but by statistics! As evidence for this assertion Bohr produced a great quantity of philosophical hot air (since uplifted to the title of the famous "Copenhagen interpretation"), whose only actual content was the remark that the experimental evidence completely disproved Boltzmann's atomistic view. Indeed, the "wave-like" empirical phenomena associated with the electron hardly resemble Boltzmann's tiny little balls flying through space and colliding with one another.

What Bohr, Heisenberg, Born, and Pauli then did was to devise a clever algebraic formalism that subsumed *both* the formal aspects of Boltzmann's work and the observed "wave" characteristics of electrons and so forth. A contradiction? By no means, answered Bohr, incorrect theories can be "complementary." The resulting concoction was crowned "quantum theory" and has been rammed down the throats of unfortunate students ever since.

Statistical physics took a further more vicious turn in the recent work of Nobel laureate Ilya Prigogine, a Club of Rome member and a White Russian aristocrat. Since 10^{75} years is longer than anyone would be willing to wait, even for 100 identical throws of a die, Prigogine introduced "nonlinear effects" to speed up "structure formation" in Boltzmann's dead Universe. According to Prigogine, life is a parasitical phenomenon, "feeding" on existing energy flows and accelerating thereby the growth of entropy in the Universe. The apparent creative, inventive aspect of human mentation and biological evolution is caused by random fluctuations on the molecular level, amplified macroscopically by nonlinear structures. In his recent books, Prigogine stresses the philosophical and political implications of his neo-Boltzmannian theories. What we need, concludes Prigogine, is an anarchist society, giving free play to "fluctuations" such as separatism, terrorism, and assorted sexual perversions! This is Teilhard de Chardin's Omega Point.

It is no accident that Prigogine is cited in the book by Marilyn Ferguson *The Aquarian Conspiracy* as a leading ideologue of the new plague of pseudo-religious cults that has recently descended upon the world. The oligarchical Inquisition—of which Prigogine is a prominent representative—is not satisfied with the mere suppression of the ontological transfinite within science: The Inquisition regards its work as completed only when *the institution of science itself is converted into a pagan cult*. Fritz Capra and Carl Sagan are typical of the "high priests" of the new cults. Presently a "great unification" is promised, fusing atomic physics with astrology, parapsychology, witchcraft, and mystical Eastern religions into a single, "organic" unity. We are promised initiation into these marvelous secrets if we just agree to give up our "old-fashioned hangup," the criterion of scientific truth.

Fortunately, the cultish concoctions promoted by Prigogine and others will not last very long. Sooner or later, the fraud of Boltzmannian statistical physics will be swept away, by a new scientific renaissance. We cannot predict exactly what form this renaissance will take, but we state with certainty that a revival of the ontological transfinite will be among its principal features.

Jonathan Tennenbaum, a professor of mathematics, directs the Fusion Energy Foundation work in West Germany.

Notes

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1. A full discussion of the hypothesis of the higher hypothesis in Plato appears in "The Science of the Human Mind: A Treatise on Fundamentals," by Lyndon H. LaRouche, Jr. in *Campaigner* magazine, Feb. 1984, (available from Campaigner Publications, 304 West 58 St., New York, N.Y. 10019, for $5 postpaid).

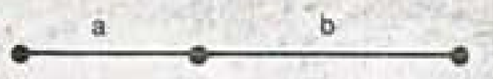
The Young Scientist

How Plants Grow in The 'Golden Mean' Ratio

by Ned Rosinsky, M.D.

Why do plants grow in the shapes that they do?

This question has fascinated scientists for thousands of years. Although the shapes of plants can become quite complicated, a great deal can be understood simply by considering what the plant needs in order to function. First, it needs to be exposed to sunlight for photosynthesis, so it will tend to grow in a shape with a large surface area exposed to the Sun. Second, it needs room to grow, so it will tend to grow in such a way that one part of the plant does not crowd another part.



$a/b = b/(a + b)$

Figure 1
THE GOLDEN MEAN RATIO
The golden mean is the ratio of division in which the smaller part, a, is to the larger, b, as b is to (a + b).

These simple ideas, if examined carefully, lead to interesting conclusions about how the plant must be shaped and how the plant must grow into its proper shape. I will show here that the kind of shapes and growing forms that best allow the plant to do its work are all related to a particular mathematical ratio called the *golden mean*, which is approximately 1.62. The golden mean is the ratio in which the smaller part of a quantity is to the larger part of that same quantity as the larger part is to the whole (Figure 1). The quantity can be just a line you have drawn on paper and then divided, a container full of marbles that you divide, or something living, like a plant.

To understand the importance of the golden mean, you must first notice that living things usually grow by multiplication, rather than addition. For example, if you start with 1 bacterium, after about 20 minutes it will have divided in half and produced 2 bacteria; after another 20 minutes, 4 bacteria, then 8, then 16, and so on. Every 20 minutes the number of bacteria doubles or, in other words, multiplies by 2.

A series of numbers that grows by multiplication is called a *geometric series*, such as 2, 4, 8, 16, and so on.

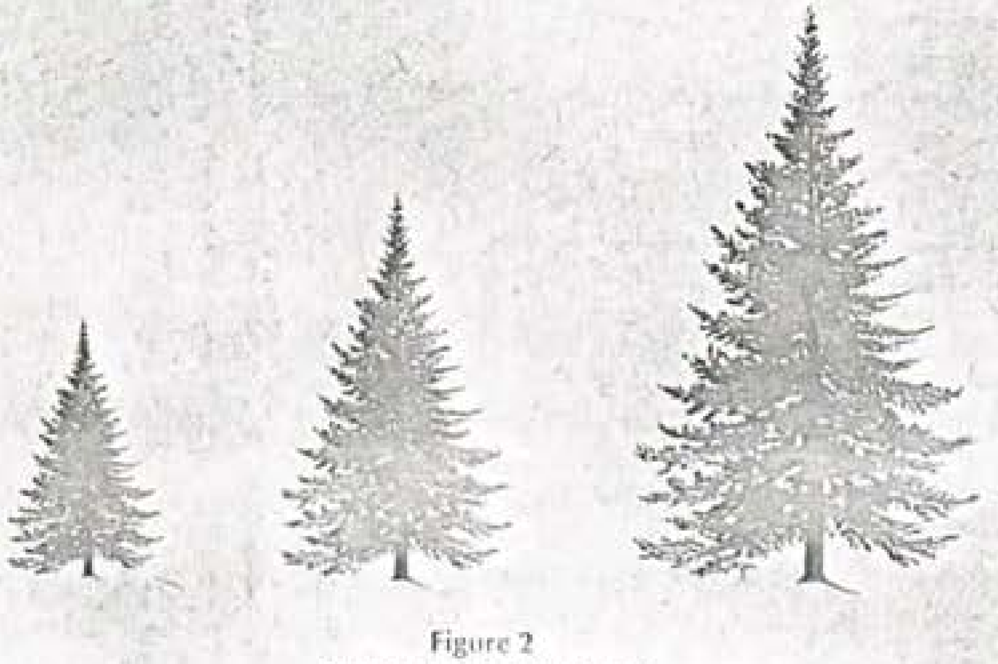


Figure 2
SELF-SIMILAR GROWTH
As the spruce tree grows, its overall shape does not change much, only its size. This gives it self-similarity in its shape as it grows.

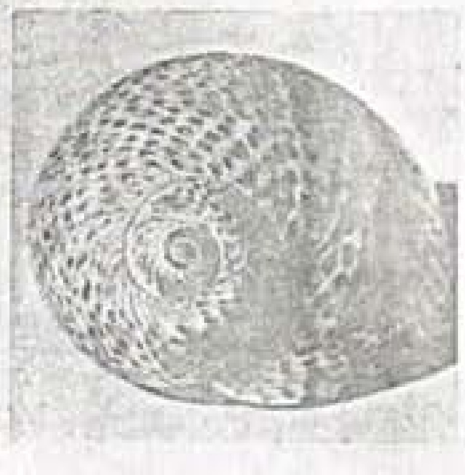
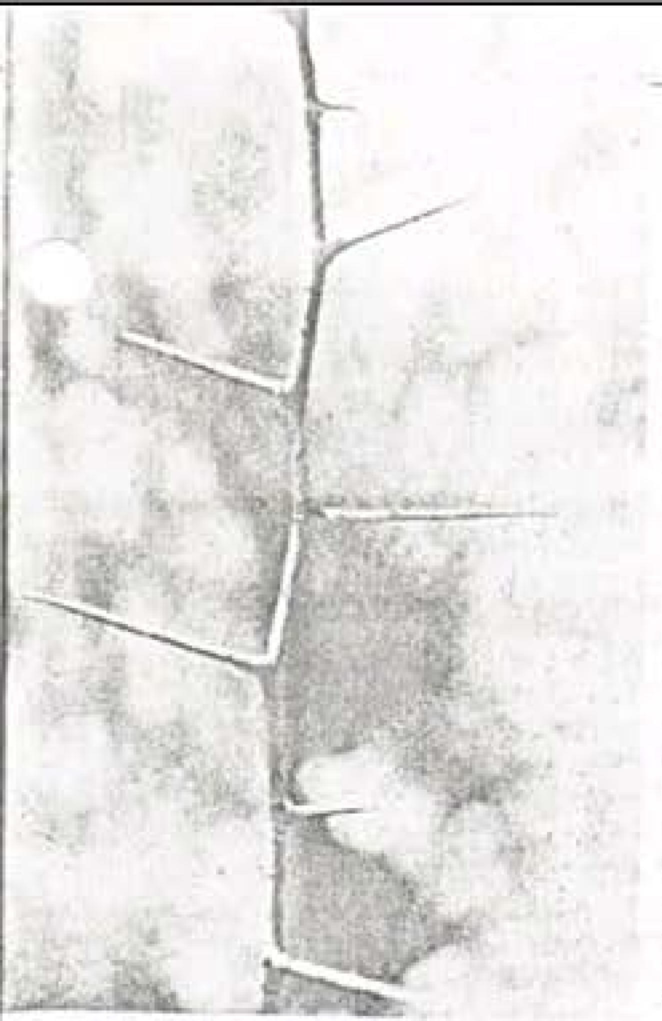


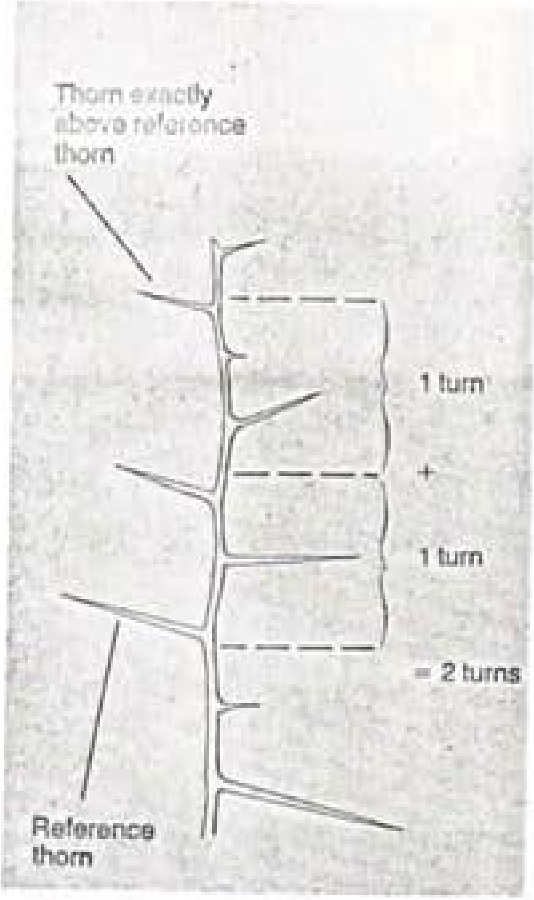
Figure 3
SNAIL SHELL
The snail grows at a rate proportional to its size at any particular time. Therefore, its rate of growth is always increasing. Since the shell is turning as it grows, it produces a spiral shape.



◄ Figure 4
SPIRAL PHYLLOTAXIS
In this plant the thorns are arranged around the stem in a spiral pattern. If you start with a particular thorn, can you see how many thorns you have to pass through above that thorn until you reach one exactly above the thorn you started with?

Source: Patterns in Nature by Peter S. Stevens, (Boston: Little, Brown and Company, 1974), p. 158.

Figure 5 ►
THE PHYLLOTAXIS RATIO
In Figure 4 you saw that two thorns that grow at the same position on the plant stem are separated along the stem by a certain number of thorns. The phyllotaxis ratio is the ratio of the number of turns in the spiral you had to make to get from your reference thorn to a thorn growing at the same position on the stem, divided by the number of thorns you passed through. Here it is two turns and five thorns, giving a ratio of 2/5.



In contrast, a series that grows by addition, such as 2, 4, 6, 8, 10, and so on (here, 2 is added each time), is called an *arithmetic series*. The main point is that plants tend to grow by geometric series, and that this kind of growth causes certain kinds of shapes in the plants (see Figure 2).

Self-Similar Growth

The reason that plants grow in geometric series (for example, doubling in size every six months) is that the entire plant is growing as one overall unit. This means that if it weighs 1 pound and it takes a month to grow another pound, then when the plant weighs 2 pounds it will take another month to grow another 2 pounds, and so on. The speed at which it grows increases, and is related to the plant's current size at any particular time. This causes the size to increase as shown in Figure 2. Since the plant is growing overall as a unit, it tends to keep the same shape even though it gets bigger. This is called *self-similar growth*.

If you look at the shape of a snail you can see the same pattern of geometric growth, only now since the shape of the snail is turning as it grows, it produces a spiral (Figure 3). This geometric spiral, also called a logarithmic spiral, is the main kind of shape you see in plants. If you can understand how this spiral works in plants you will begin to see why they are shaped the way they are.

A good example of a spiral in a plant is the way the leaves or thorns are located on a plant stem in many kinds of plants (Figure 4). Look at the overall shape of a spruce tree, which is a cone. The branches of the tree stick out in a pattern that spirals around the tree's cone shape (Figure 2). Now, let us see how this geometric growth connects to the specific ratio of the golden mean.

If you look at various types of plants, you find that the leaves around the stem are arranged in different kinds of spiral patterns. If you pick any leaf and call it a *reference leaf*, and then start counting leaves above it as they spiral around up the plant stem, sooner or later you will find a leaf that is directly above the reference leaf on the stem. You may have to go a number of times around the spiral before you find this leaf.

Now, if you count up the turns around the spiral you made, and divide it by the number of leaves you went through, you get a ratio that is characteristic for each plant species. For example if you made 5 turns and passed 13 leaves, the ratio is 5/13. This is called the *phyllotaxis ratio*. (Phyllotaxis comes from the Greek words for leaf, *phyllon*, and order, *taxis*; the plural of taxis is taxes.) See Figure 5.

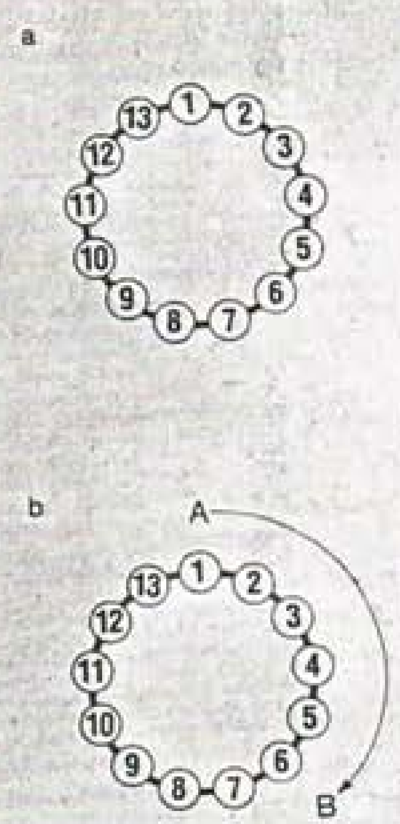
The Phyllotaxis Ratio

These phyllotaxis ratios form an interesting series of fractions: 1/1, 1/2, 1/3, 2/5, 3/8, 5/13, 8/21, 13/34, and so on. What is interesting is that all the numbers come from a series called the *Fibonacci series*, named after the 12th-century mathematician who discovered it. The Fibonacci series is formed by starting with 1, adding another 1, and then getting each next new member of the series by adding the previous two members: 1 + 1 = 2, 1 + 2 = 3, 2 + 3 = 5, 3 + 5 = 8, and so on. This forms the series 1, 1, 2, 3, 5, 8, 13, 21, 34, and so on. (See Professor von Puzzle, p. 59.)

The plant phyllotaxes are ratios formed by taking two numbers from this series that are separated by one number; for example 3 and 8 or 5 and 13.

This particular series has some interesting geometrical properties. Take a circle and divide it into a number of parts according to one of the Fibonacci numbers, say, 13. Then count off sections of the circle by the Fibonacci number that is two numbers behind 13, which is 5. This gives you the pattern shown in Figure 6.

Figure 6
UNPEELING THE FIBONACCI SERIES

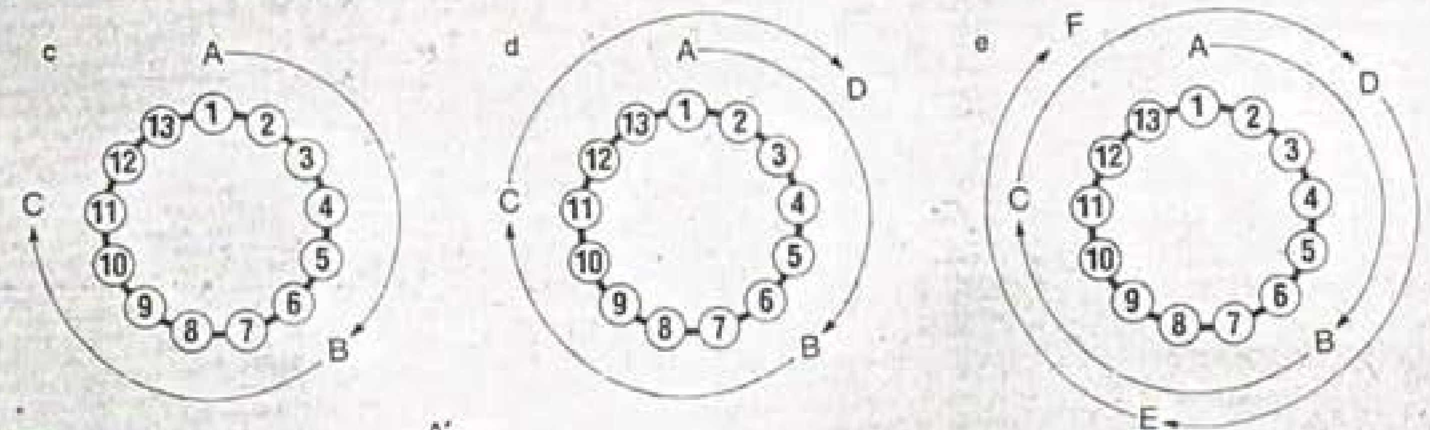


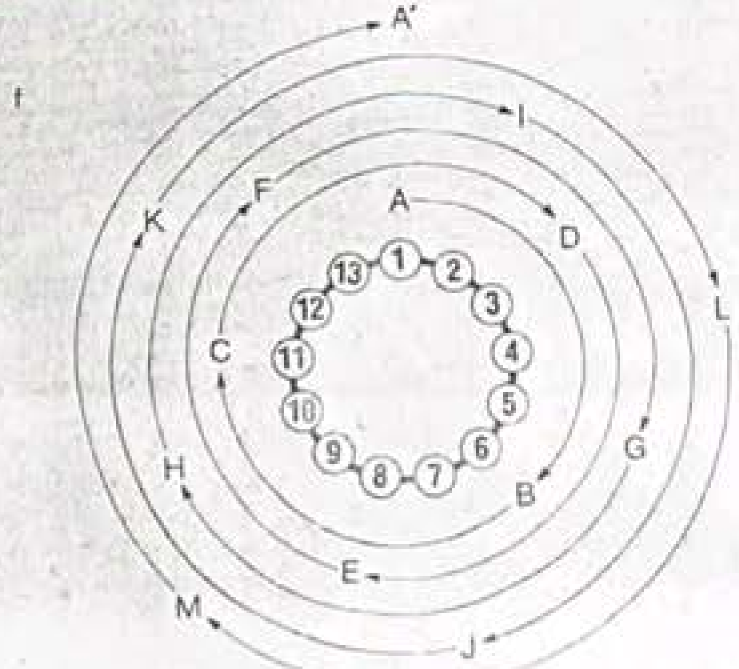
In this example we choose a Fibonacci number, 13, and divide a circle into that number of parts (a). We then begin with one of the sections and start counting off sections around the circle according to the number that is two numbers back on the Fibonacci series, 5 (b). Call the original point on the circle A and the next point B. Notice that B has divided its space of 13 sections into two parts of 5 and the remaining 8.

Next we continue the process by counting off another 5 sections to arrive at C (c). Point C divides its space, which is the 8 sections from B back around to A, into two parts of 5 and 3. Next, we go around another five sections, passing A and arriving at D (d). Note here that D divides its space, which consists of the 5 sections bounded by A and B, into the two parts of 2 and 3.

In e, two more points have been added: E divides its space into the parts 2 and 3, and F divides its space of 3 sections bounded by C and A into the parts of 1 and 2. In the final figure, f, the process is continued for the full 13 points, until the spiral returns to A.

Note several interesting things: First, all the divisions are Fibonacci ratios, including all of the remaining points after E. Second, each section of the original 13-section division of the circle has been used exactly once in this process. Third, notice that the counting-off process has revolved around the circle five times exactly, and has used up 13 spaces, which in a plant would give a phyllotaxis ratio of 5/13.





CALCULATIONS OF FIBONACCI RATIOS FOR THE FIRST FEW TERMS OF THE FIBONACCI SERIES

1/1 = 1.0000
2/1 = 2.0000
3/2 = 1.5000
5/3 = 1.6666
8/5 = 1.6000
13/8 = 1.6500
21/13 = 1.6154
34/21 = 1.6191

As you can see, each new place counted off on the circle divides its space into a Fibonacci-type ratio, either 1/1, 1/2, 2/3, 3/5, 5/8, 8/13, and so on. Notice that these ratios are the same as the ones you would have produced if you had counted off 8 spaces going around the circle in the opposite direction. The Fibonacci phyllotaxis can also be obtained by taking two consecutive Fibonacci numbers, 13 and 8 (that is, without skipping a number in the series), and going around your circle in the opposite direction (Figure 7b).

You will obtain a similar picture by starting out with a circle divided into equal parts by any other Fibonacci number, such as 21. (With the circle divided into 21 parts, you would then count off segments in groups of 13.)

Looking Down at the Plant

Now, consider the sectioned-off circle you have drawn as a diagram of a plant, looking down at the plant from the top, with each of the above countings in the circle representing a new leaf sprouting out. You can see that each leaf is dividing its space into a Fibonacci ratio. What can you tell about these ratios?

First, each place you have marked off on the circle divides the previous space marked off on the circle nearly in half. Thus, each new leaf is almost evenly placed between two previous leaves, giving it lots of *space in which to grow*. Second, each leaf also has lots of *space to get sunlight*. In these divisions, the space on one side of a leaf is never more than twice the space on the other side.

Now, calculate the ratios you have marked off as they get farther along in the series, dividing the numerator by the denominator. You can see that the ratios get closer and closer to the ratio 1.62, which is the golden mean (see table). Some plants, in fact, have the golden mean ratio as the angle of the separation of consecutive leaves (Figure 8).

What about other ratios? Let us try an experiment with a ratio that is not from the Fibonacci series. Keeping the 13-divided circle, if you count off by 7 sectors at a time (instead of 8 as in the Fibonacci series) you get within one section of the first leaf after just two leaves, causing unnecessary crowding. If you use 4 to count off, or rotate, you get again within one section of the start within three leaves (Figure 9). You can try this with other numbers of section divisions and rotations.

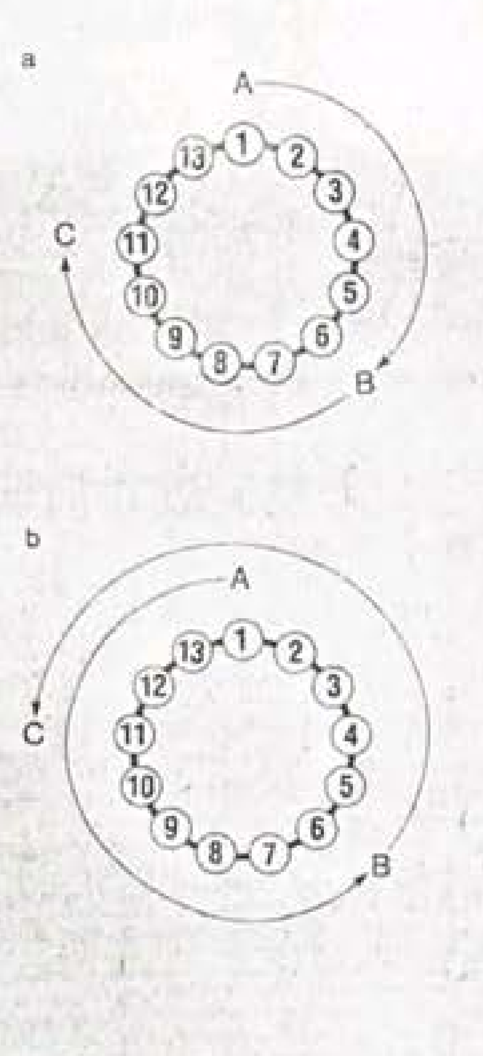


Figure 7
ALTERNATE FIBONACCI COUNTING
In a, the 13-sector circle is counted off in groups of five, giving the points A, B, and C. In b, the same circle is counted off in groups of 8, in the opposite direction, giving the exact same location of the points A, B, and C. We see, therefore, that the neighboring Fibonacci number to 13, which is 8, can be used to give the same results as 5.

If you work out this example all the way, as was done in Figure 6, you will see that all 13 sections are used up. Now, however, instead of 5 complete rotations around the circle, there are 8, giving a phyllotaxis ratio of 8/13.

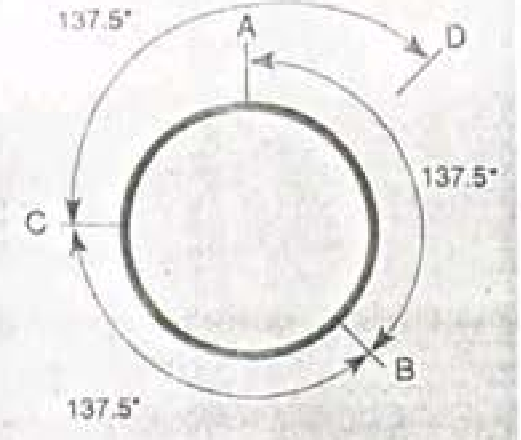


Figure 8
GOLDEN MEAN SEPARATION OF LEAF ATTACHMENT LOCATIONS
Here the circle is divided by the golden mean, which is approximately 1.62 or 137.5 degrees (out of 360 degrees). Notice that the points are located in positions that give them ample room as each is successively laid down.

To see why the Fibonacci numbers work so well, look more carefully at what happens in the above example of a circle divided into 13 sections by counting off 5 (or the equivalent, 8, in the opposite direction). The first counting divides the circle into 8 and 5, which are the two previous terms in the Fibonacci series. The next counting, or rotation, of 5 sections divides the space of 8 sections between the first and second leaves into two portions of 5 and 3, which are the next numbers counting backwards in the Fibonacci series.

Now, the next counting of 5 goes past the first leaf and divides the space of 5 sections between the first two leaves into two portions of 2 and 3. Again, this is done by moving backwards in the Fibonacci series, continuing the process (Figure 6). This is really like an "unpeeling" of the Fibonacci series by subtraction!

Since the Fibonacci ratios get progressively closer to a constant value, the golden mean, the series becomes close to a geometric series in which the golden mean is the constant factor of multiplication. Plants frequently flip from one phyllotaxis to another in the course of early development, or in the evolution of new species of plants. Since the ratios are in a geometric series, this

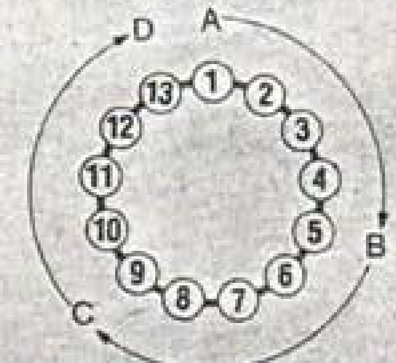
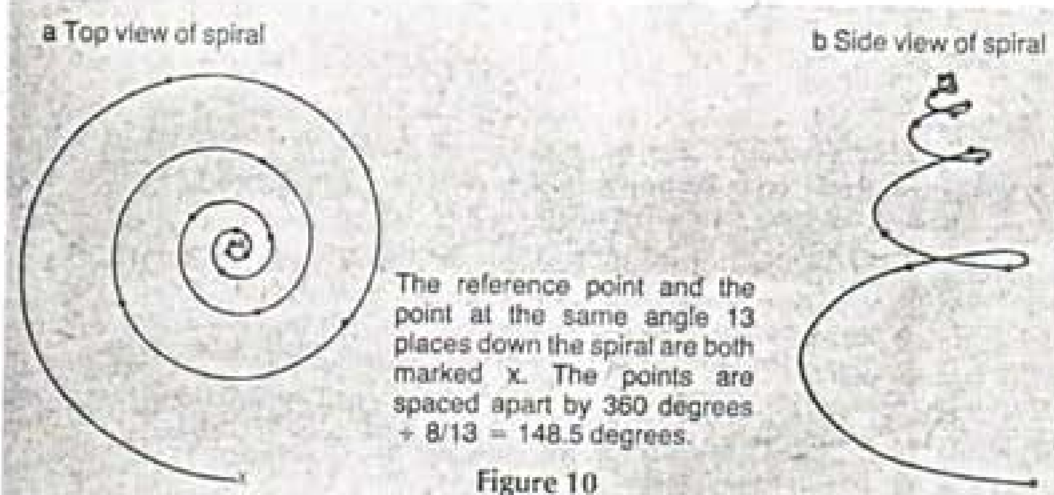


Figure 9
NON-FIBONACCI DIVISION OF THE CIRCLE
Using the circle divided into 13 sections, we try some counting number other than 5 (or the equivalent 8), such as 4. Here the first added leaf, B, divides its space up into 4 and 9, which is less symmetric than the 5 and 8 division. The second leaf added, C, divides its space between B and A of 9 sections into 4 and 5, a good division, but then its next leaf, D, divides its space of 5 sections into 4 and 1, a highly unequal division. Similar highly unequal divisions occur with other choices of the counting number, such as 3 or 7.



The reference point and the point at the same angle 13 places down the spiral are both marked x. The points are spaced apart by 360 degrees ÷ 8/13 = 148.5 degrees.

Figure 10
SPIRAL ARRANGEMENT OF LEAF POSITIONS
Here the circle representation is uncoiled to reveal the underlying spiral of leaf arrangement. In this example the 13-section circle becomes a 13-section spiral. After 5 turns above a given point in the spiral, there is another point at the same angle on the spiral. Again, another spiral could have been drawn through the same 13 points but in the opposite direction. This spiral would have had to turn 8 times between the matched points. The top view of this spiral is shown in a, and the side view of the spiral, looked at obliquely, is shown in b.

aspect of evolution is really a geometric jump, from one ratio to another similar ratio. This is another aspect of self-similar growth that is more easily seen in the overall growth of the snail or the overall shape of a tree as it grows.

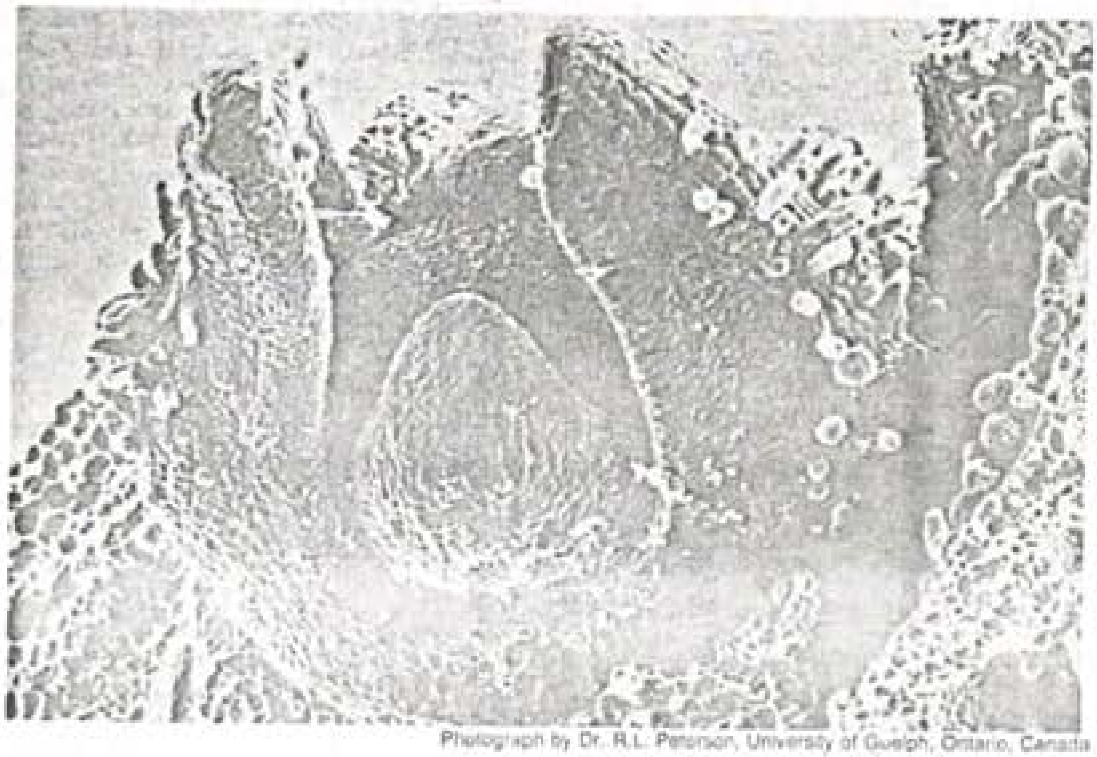
Next, take the circle on which you have drawn the leaves and re-draw it back to its original spiral shape (Figure 10). Here you can see that as the Fibonacci series is "unpeeled," the leaves are spread out vertically, so that neighboring leaves on the circle are far away from each other on the grown plant. The outward growth of elongation of the leaf stems makes sure that the new leaves do not shadow the old leaves, which may be directly under them or near them in the circle model.

This completes the overall picture, showing that the plant is generally shaped like a cone with a spiral of leaves coming out of a central stem. The plant always grows in such a way that it expands into a new size but keeps a similar conical shape.

The Question of Crowding

The same question of crowding applies to the small piece of plant tissue at the growing tip of the plant where the new leaves actually sprout. This tissue is called the *meristem*, and measures less than 1/32 of an inch across. The new leaf buds come out of this tissue at the same angles they will have on the stem as adult leaves. Therefore, the crowding question for growth and sunlight is exactly the same as it is in the case of starting the leaves out with room to grow on the meristem in the first place (Figure 11).

This shows that the question of what the best leaf spacing is for sun-



Photograph by Dr. R.L. Peterson, University of Guelph, Ontario, Canada

Figure 11
HOW BUDS GROW ON THE MERISTEM
The meristem shown here is magnified 250 times, and the outer leaves are cut away to expose the very youngest leaf buds as they begin to form on the surface of the meristem tissue. Notice how close the young leaf buds are to one another.

light, for growth, for growing out in the meristem, and for evolution as well, are all really the same. These problems require the same solutions, and the best solutions are all based on self-similar geometric shapes related to the golden mean.

Some Experiments

In order to look at these ideas more clearly you can do several kinds of experiments. First, do the example described above of dividing a circle into a Fibonacci number of sections and then counting off sequences of sections according to the next smaller Fibonacci number. Notice how the addition of each leaf divides the space for that leaf in a Fibonacci ratio.

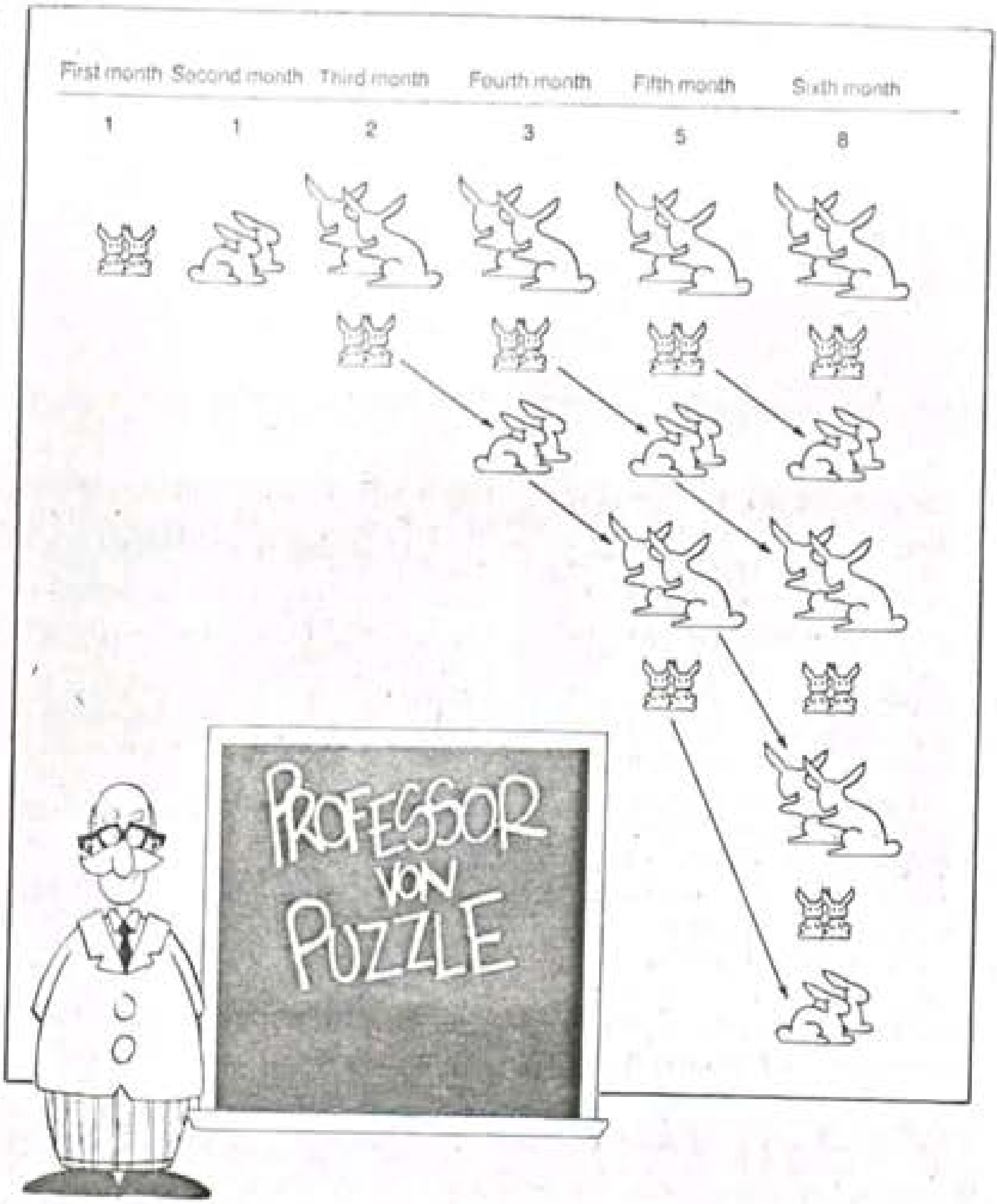
You can try this exercise with other numbers that are not from the Fibonacci series to see whether the leaf spacing is as good.

Second, collect plant samples that have the various Fibonacci ratios in their leaf or thorn patterns around the stem. Examine these specimens from various angles to see the effect of the spacing on sunlight exposure and growth crowding. A few common examples are the 1/3 ratio in beech trees, the 2/5 ratio in oak, the 3/8 ratio in poplar, and the 5/13 ratio in willows.

Third, dissect the meristem tip of a plant under a low power microscope or strong hand lens, to see the pattern of leaf buds and how they form a Fibonacci geometry. Notice the extremely close crowding of growth at the meristem tip.

Fourth, take snapshot pictures of a growing plant every day at the same time from the same place, in order to visualize the growth patterns that follow the self-similar patterns you have outlined.

Fifth, a more challenging experiment would be to investigate why some plants that may start out in a conical shape change to other shapes. I'll give you a hint: The increase in crowding of the plant (its population density) may affect its shape as it attempts to maximize exposure to the Sun or to ground water. For example a lone oak may be wider at its base, but an oak in a crowded rest may be wider on top.



Brother Bonacci's Rabbits

Filius (Brother) Bonacci, who was born in Pisa, Italy, in the year 1170 AD, discovered a unique series of numbers that have ever since borne his name—the Fibonacci series. Brother Bonacci is said to have discovered the series observing the reproduction of rabbits.

Suppose we want to raise rabbits, and we start with a newborn pair—a male and a female. Let's assume for simplicity that each rabbit pair takes one month to mature to the point that it can produce offspring, and that the female carries her young for one month. That means it will take two months from the birth of the first rabbit pair to produce the first offspring. Let's also assume for simplicity's sake that each litter consists of one male and one female rabbit.

Now let's look at the growth of the rabbit population by month. In the first month we have *one pair*, and so also in the second. At the beginning of the third month a new pair is born. Now we have *two rabbit pairs*. At the beginning of the fourth month, that new pair is maturing, and the original pair give birth to another pair. The total number of pairs now *equals three*.

What do you think happens in the fifth month? Let's see. The original pair gives birth to yet another pair, making four pairs. But the pair that was born at the beginning of the third month also has a pair. So the total number of pairs *equals five*.

The chart helps you to see how this growth continues, producing the series named after Filius Bonacci:

1, 1, 2, 3, 5, 8, 13, 21, . . .

This series has two very important

properties. First, any term in the series is equal to the sum of the two previous terms. For example:

$$2=1+1; \text{ or } 13=5+8$$

Knowing this, you can produce the series just beginning with 1 and 1.

Second, the ratio of any two neighboring terms of the series is almost equal to the number 1.618, which is the ratio of the golden section or golden mean (see "How Plants Grow," p. 54). The higher we get in the series, the more true this is. Try it yourself. Use the first property I have just shown you to write out the Fibonacci series a few terms beyond the highest number (21) that I have given you. Now take any two neighboring numbers and divide them, the higher by the lower. (For example $21 \div 13 = 1.615$). You may use a calculator to facilitate this long division.

You see that the higher you go in the series, the closer it gets to the ratio of the golden section, which is approximately 1.618. This is called *convergence*. The ratio of neighboring terms in the Fibonacci series converges on the golden section.

A Geometric Construction

You can also produce the Fibonacci series by a geometric construction. Start with a square whose sides we consider to be 1×1. Now, you need only follow a simple rule to generate the Fibonacci series. The rule is: Always add a square to the longest side of your figure. Since we begin with a square, no side is the longest; we can add a square to it on any side (Figure 1).

Figure 1

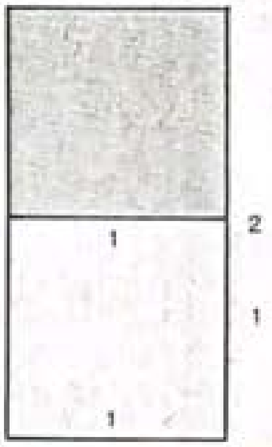
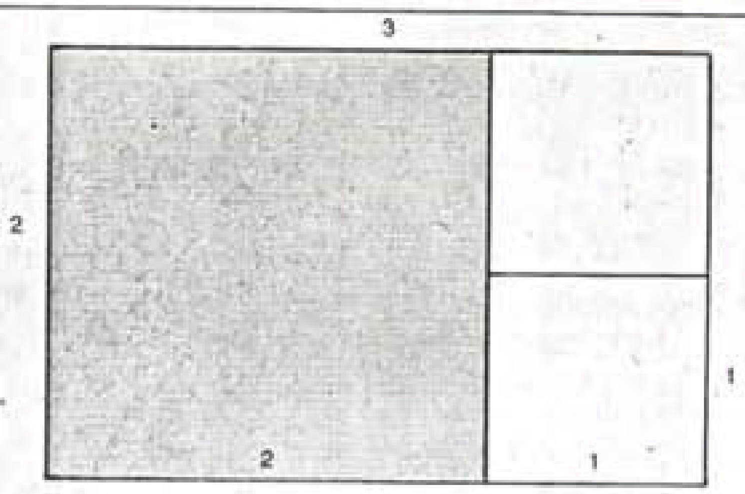


Figure 2



But now we have a figure twice as long as it is wide (2 × 1). So we add a square to its longest side (Figure 2).

Now our figure is 3 × 2. As we keep adding squares to the longest side, we get figures of 5 × 3, 8 × 5, 13 × 8, and so on. As the figure grows larger, the proportions of the rectangle hardly change. This is self-similar growth. The size increases, but not the shape. All living things grow this way.

Now for the puzzle: What will happen if you start with any rectangle and construct a square on its long side, making a new, larger rectangle? Repeat the process a number of times. Then make a series of numbers from the lengths of the rectangles you have constructed. What can you discover about these rectangles?

—*Laurence Hecht*

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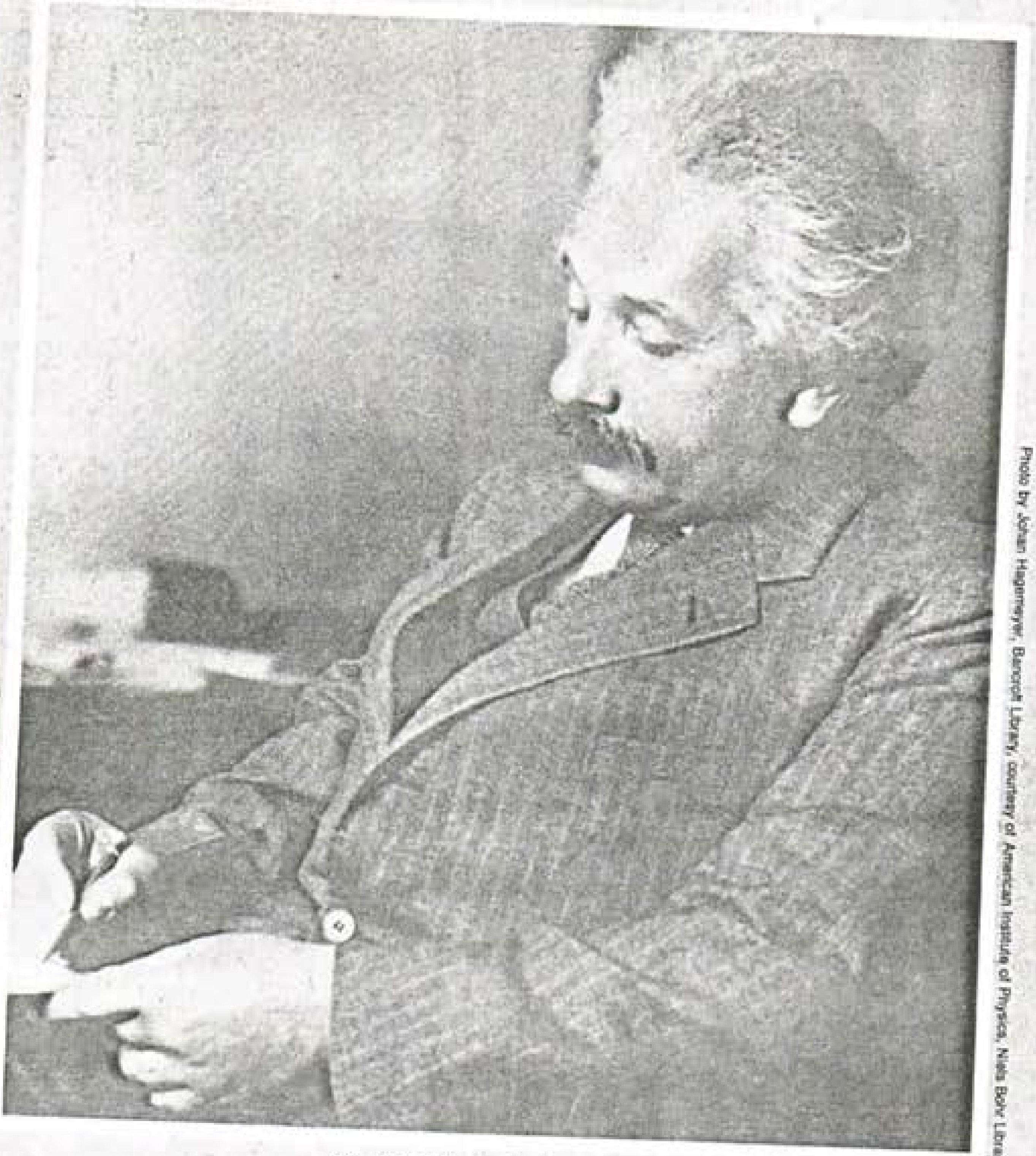
Why I Must Attack Albert Einstein

by Lyndon H. LaRouche, Jr.



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Dr. Albert Einstein, circa 1930.

EDITOR'S NOTE: An "Einstein debate" emerged after the 100th birthday celebration of Einstein in 1979, in which the name Einstein has been repeatedly misused solely to strengthen cultural pessimism and the antiwar movement. This article contrasts sharply with the so-called Einstein debate, and treats with scientific precision the question of morality in scientific work.

The origins of the ugly Einstein debate are as follows: In November 1980, an essay by the West German physicist Unsöld pinned on Einstein the blame for atomic weapons, and therefore all modern warfare. Writing in the official publication of the German Science Association, Unsöld vented his anger over the just-concluded "Einstein Year" celebration: "[H]ardly anyone dared to remind us," he wrote, "that Einstein's name is also closely associated with with atomic bomb. . . . Much has been said in 1979 about the 'responsibility of scientists.' But of Haber's poison gas and Einstein's atomic bomb . . . we hardly heard a single word." (The year 1979, it should be noted, was the year NATO made the bilateral decision to station middle-range missiles in Western Europe.)

The green and peace movements immediately put Unsöld on their lecture circuit, giving him the opportunity to spread his ideas on "scientists' responsibility" throughout West Germany. His speeches against Einstein soon provoked an international outcry, including charges that Unsöld's attack was motivated by antisemitism. The British magazine *Nature*, for example, reported April 16, 1981 that "Unsöld, a theoretician, now 75, appears to have begun his attack on Einstein at a [university] symposium . . . when he said that Einstein was guilty of crimes, no less serious than those of Hitler. . . . Unsöld has been charged with antisemitism." Why the peace movement would so zealously rely on Unsöld's view of "scientists' responsibility," becomes clear from the following citation from the above-mentioned Unsöld article against Einstein:

> Man's psyche apparently possesses *two regions*, which operate according to quite different rules. . . . The deliberative, goal-oriented and critical activity of our "I" resides . . . in the neocortex. . . . Opposed to this is the genetically more ancient limbic area, or brain stem, which is where the instincts, the "Id," reside. This latter portion has remained unchanged since the stone age. Thus we understand that, even in humans with extremely differentiated thinking and investigative capacities—people with "exceedingly high intelligence"—the old stone-age instincts are lurking in the background, instincts primarily aimed at acquiring power, acclaim, etc., and which would not hesitate to destroy anything which could get in the way.

In Unsöld's twisted and antihuman view of man—as in that of the green and peace movements—there is no place for moral or statesmanlike activity, and no notion of how science and technology enable mankind to not only survive, but to develop. The Einstein debate spurred by Unsöld promoted nothing useful scientifically; it served only to promote the European peace movement's simple-minded formula that "Science = Weapons."

With great personal reluctance, I find myself obliged to attack certain features of the work of the late Albert Einstein publicly. This reluctance bears upon Einstein as a man, not as a physicist. Although I am not a physicist or mathematician as such—chiefly because I early abhorred, morally, certain leading features of contemporary textbook and classroom mathematics—I am not awed by Einstein's reputation in science. I know enough of the absolute fundamentals of scientific work to know with certainty that important aspects of Einstein's work depend upon childishly outrageous blunders of assumption and method. What I like about Einstein is that, although he permitted himself to be used and corrupted to a certain degree, he drew the line beyond which he would not permit himself to be used for corrupt purposes. For that latter reason, and for reason of certain important issues on which Einstein was morally on the right side, I would prefer to defend him, than to be obliged to attack his memory.

My motives for attacking Einstein's memory are eminently, urgently practical ones, reasons he would admit are of an obligatory moral as well as practical character. Briefly, the threat of a new general war, this time probably a thermonuclear war, and the threatened collapse of the world's economy—unless a technological revolution intervenes—require a very special kind of "crash-program" effort in development of three interrelated areas of scientific investigation and technological applications. These three areas are: (1) controlled thermonuclear fusion and related aspects of relativistic physics; (2) a general, radical revision in the theory of quantum electrodynamics, with emphasis on the need for a comprehensive and coherent doctrine of coherent radiation—new, rigorous distinctions between *energy* and *work*; and (3) revolutionary breakthroughs in biophysics, centered upon control of aging of tissues within the whole processes of human bodies, a fundamental breakthrough in the physical definition of the word *life*. These three breakthroughs cannot be accomplished without throwing overboard the *axiomatic notions* of a statistical theory of heat, axiomatic notions embedded in much of Einstein's work, and the root of every major error in his work.

In these matters, my own special variety of competence lies both in my mastery of empirical principles of economic science, and a life dedicated chiefly to mastery of what is best described as "the third level of scientific hypothesis," what Plato's writings define as the notion of an *hypothesis of the higher hypothesis*. In my own case, my susceptibility to the Platonic (or, Neoplatonic) viewpoint was an outgrowth of a childhood and youthful saturation with matters of theology, most emphatically that of the Gospel of St. John. It was consistent that during my 13th and 14th year, I should have been won totally to the methodological outlook of Gottfried Leibniz, most emphatically the Leibniz of the Leibniz-Clarke correspondence and the *Monadology*. This theological point of entry into scientific work has been no defect, as the instances of St. Augustine, and the founding of modern science by the 15th-century Cardinal Nicholas of Cusa best indicate the connections to be noted.

What turned me away from mathematics, as I encountered taught mathematics in the textbooks and classrooms of my youth, was the recognition that the lattice structures of a logically consistent mathematical edifice depend upon the validity of the axiomatic and postulational assumptions which underlie all mathematical systems. It has always appeared morally indefensible to me to assert that anything is true mathematically merely because of plausible empirical consistency with mathematical schemas. If the underlying assumptions are in error, then the entire edifice of existing mathematics collapses. Perhaps, at any given point in progress of knowledge, it may not be possible to settle these problems respecting underlying assumptions, and scientific work must not be halted merely because we know some more or less pervasive defect to exist in given mathematical physics. Yet, at the same time, it is morally wrong, and ultimately destructive of scientific work, to pretend that the existing mathematics is self-evidently right as to principles when it is demonstrable that some underlying assumptions are of a dubious character.

This doubt proved most fruitful. The Wiener-Shannon doctrine of "information theory," derived from the statistical theory of heat, expresses the most immoral features of existing scientific opinion, depending most directly upon assumptions which are provably absurd, assumptions conclusively proven absurd long before the work of Boltzmann, Gibbs, et al. *Negentropy*, it appeared to me during late 1947 and early 1948, when I first encountered the Wiener-Shannon dogma, is characteristically the quality of living processes. *Life* as an active, efficient principle, must be adduced directly, empirically, from living processes. It was my preferred argument then, and still today, that the professor who undertakes to discover whether or not life is possible, from the standpoint of the statistical theory of heat, or the mechanistic standpoint otherwise expressed, is posing actually the question whether he himself exists to have the power to express an opinion on any matter of inquiry. Therefore, I was led through the work of Nicholas Rashevsky on mathematical biophysics, to challenging Rashevsky's methodological assumptions. This led ultimately to a year of wrestling with Georg Cantor's notion of transfinite orderings, a vantage point which made the essential, underlying features of the work of Bernhard Riemann directly accessible. My own fundamental discoveries in economic science, dated from 1952, were the result of that.

Energy unquestionably exists, to the effect that increase of measurable energy-flux density of processes is the proper first-approximation measure of work accomplished by thermodynamic processes. Yet, "energy" and "work" are not the same thing. Work produces energy, and the conversion of energy into work is the crux of the matter. It is the comparison of the work gained with use of energy against the work required to produce energy in the form required, which is the essential definition. This recognition, and its bearing upon the measurability of technology as such, was the basis for my original discoveries of 1952, a discovery which has undergone a radical improvement in depth and scope during the recent five years—chiefly due to my collaboration with Uwe Parpart Henke, Dr. Jonathan Tennenbaum, and others, who have enabled me to locate my earlier conceptions within the broader range of fundamentals of mathematics and mathematical physics.

The most recent developments in my own work began during 1980. The LaRouche-Riemann method of economic forecasting has proven itself the only competent forecasting method in existence today, but there are shortcomings within the present form of the forecasting practice, such that the method is of the highest accuracy presently available for short-term general forecasting, but not satisfactory to the same degree for short-term forecasting of subsectors of the same general economic process. Therefore, a constant improvement, refinement, in the program has been characteristic of the work since it was launched in December 1978.

The direction of these continuing refinements took a wrong turn during mid-1980, a wrong turn I recognized to be disregard for the deeper implications of the "delta" in Leibniz's formulation of the differential calculus. This, I warned my associates then, obliges us to emphasize the fact that the notion of a quantum-value in physical processes is nothing but Leibniz's notion of the fallacy of "infinite divisibility," one of the points upon which he based his (accurate) argument, that Newton's form of the calculus was useless and false to physical reality. To solve certain tasks of refinement in economic analysis, I concluded, it is indispensable to brush aside prevailing, accepted interpretations of the quantum-notion and to derive the necessity of this notion from the same basis as Leibniz's approach, rejecting the assumptions underlying what is called quantum mechanics. When my associates failed to effect quickly enough the breakthrough of the form I saw necessary, I mobilized myself to set the required solution into motion, demanding that we examine the matter from the standpoint of a rigorously synthetic-geometrical approach to construction and interpretation of conical (complex) functions.

This program began, during 1981, with an attack on the simplest phenomenon of all conical functions: the determination of the correct, well-tempered values for the musical scale as an elementary exercise in differential geometry, as completed by Jonathan Tennenbaum and Ralf Schauerhammer during autumn 1981. This led, further, Tennenbaum's reconstruction of Minkowski's doctrine of special relativity through use of paired cylindrical functions, in respect to which I insisted this must be corrected by an additional, crucial step, of substituting conical functions for the cylindrical. This led to Tennenbaum's discovering a fresh view of Gauss's arithmetic-geometric mean. Through the collaboration with Tennenbaum, I pointed out that the view of generalized elliptic functions, as subsumed by Gauss's derivation of the arithmetic-geometric mean, was the basis for both Riemann's famous 1854 habilitation dissertation, "On The Hypotheses Which Underlie Geometry," and the proper basis for defining both the principle of the quantum and Leibniz's "delta."

The outgrowth of Tennenbaum's continuing work on this matter gave us a much more powerful apparatus than I had previously employed for economic science. This, and its general implications, I reported to the July 3-4 [1983] conference of the International Caucus of Labor Committees in Reston, Virginia. The included judgment is that a "general theory of relativity," as distinct from "special relativity,"

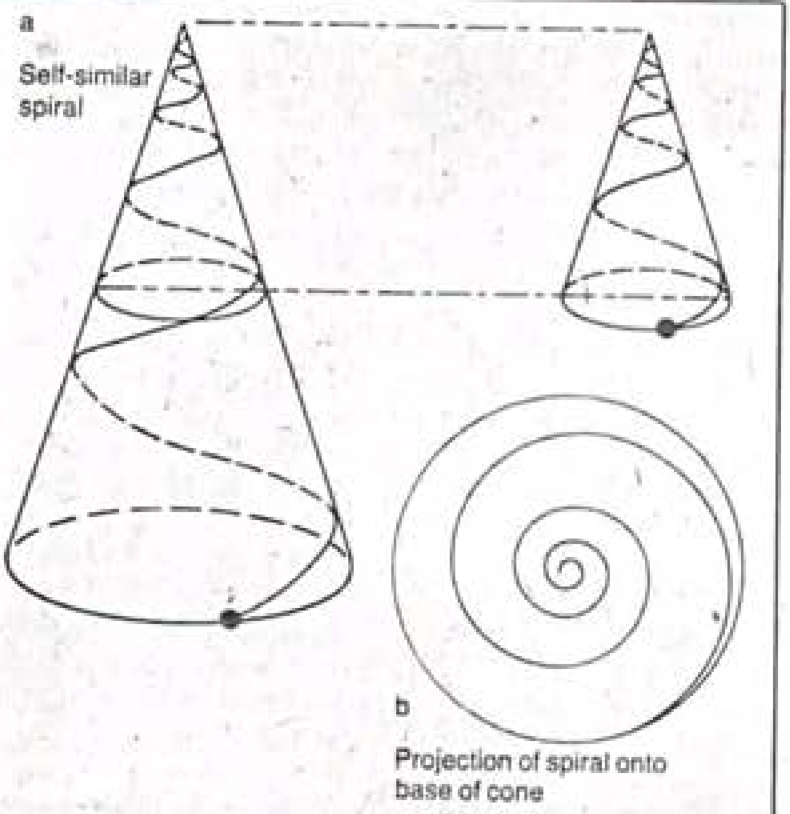


Figure 1
SELF-SIMILAR SPIRAL ON A CONE

A self-similar spiral (a) is the proper mathematical definition of work. The self-similar characteristic of the figure is that a cut made anywhere parallel to the base of the cone produces a smaller cone and spiral identical to that of the larger cone, except for its scale and rotation. Each cycle of the spiral defines a circular cross section of the cone.

In projection (b), the spiral on the cone becomes a two-dimensional spiral.

does not exist, that the search for a unified field within the scope of a supposed general relativity is a result of wild, unrecognized fallacies embedded in an incorrect formulation of what is called "special relativity." This argument does not depend upon any complex analysis of the matter; the errors are entirely of the most elementary kind, the most primitive errors of assumption, which therefore admit of direct, simple demonstration.

I summarize the bare essentials of the case which I presented to that conference, beginning with a definition of the notion of an hypothesis of the higher hypothesis.

The Three Levels of Hypothesis

In scientific work, there are three levels of hypothesis:

(1) *Simple hypothesis.* The underlying assumptions of prevailing scientific knowledge are assumed to be valid, both for scientific work generally, and also for the particular area of inquiry to which some experimental hypothesis is addressed. The assumption of consistency with existing structures and underlying assumptions of scientific work, especially mathematical physics, is the basis for design and testing of the experimental hypothesis.

(2) *Higher hypothesis.* This is an experimental hypothesis addressed to the question whether evidence requires us to overthrow one or more of the fundamental assumptions underlying contemporary scientific work. A successful higher hypothesis produces a greater or lesser scientific revolution, and, by implication, greater or lesser technological revolution.

(3) *Hypothesis of the higher hypothesis.* This presumes that a succession of scientific revolutions represents an orderable series of higher hypotheses, on the condition that the succession correlates with an increase in the potential per capita power of society over nature. This poses the question, whether a succession of higher hypotheses meeting that requirement is demonstrably the result of some common principle of discovery. In other words, is there some principle of discovery which can be successively applied to successive scientific revolutions to generate the next scientific revolution in that series? Experiments which test hypothetical principles of discovery of this sort define the notion of an hypothesis of the higher hypothesis—*the third level of hypothesis.*

There is a current of modern science, beginning with the discovery of the *isoperimetric principle* by Cardinal Nicholas of Cusa during the 15th century, which insists that all of the fundamental questions of scientific knowledge exist for comprehension only on the third level of hypothesis. This current of science is typified by Cusa, Leonardo da Vinci, Johannes Kepler, Gottfried Leibniz, the Carnot-Monge Ecole Polytechnique, Karl Gauss, and Bernhard Riemann—a current sometimes identified in English literature as "continental science." This is the current to which this writer adheres.

This adherence takes the practical form today of the writer's specifications for design of a needed "crash program," both to implement the President's strategic doctrine enunciated first on March 23, 1983, and to cause that work in military technology to spill over efficiently into the world's civilian economy, to foster a general explosion in economic growth. The designs proposed by this writer are modeled, as a matter of reference, on the combined military, scientific, and educational work of the Ecole Polytechnique under Lazare Carnot and Gaspard Monge. Otherwise, the writer situates within that model of reference the question of a governing administrative-methodological principle approach to make such a social instrument of "crash-program" work effective for the specific objectives in view today.

The importance of this approach is most readily demonstrated from a military standpoint. In opposition to those "systems analysts" whose influence has ruined the defenses of the United States, military technology defines a domain of accelerating technological attrition. The best measures deployed today produce countermeasures, countermeasures which require more advanced measures to overcome them. The succession of measures and countermeasures so defined is sometimes named "technological attrition," and is sometimes called an "arms race." There is no alternative to such an "arms race," but to prepare to lose the next war.

The same principle of "competition" exists in the nonmilitary economy. However, one may ignore this principle of "competition," on the assumption that a nation may survive national economic bankruptcy, but might not survive

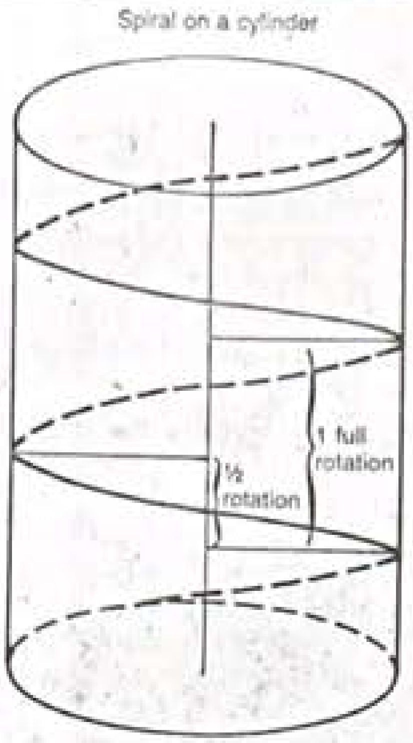
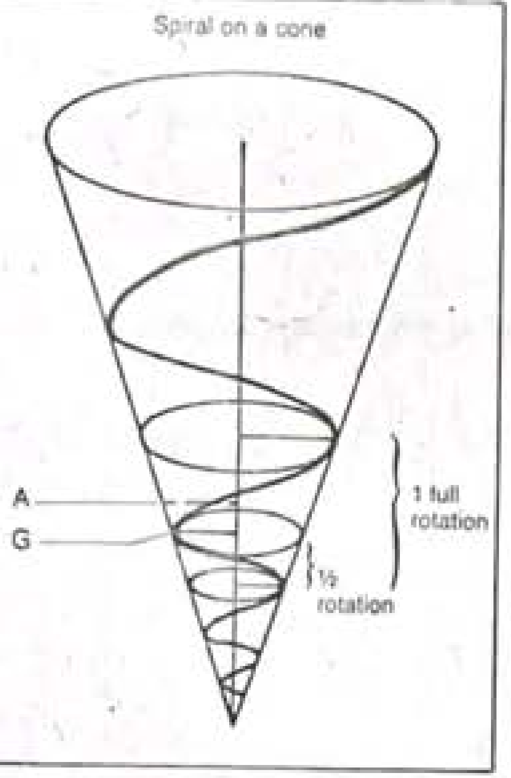


Figure 2
IDEAL REPRESENTATIONS OF ENERGY AND WORK

At left, a spiral on a cylinder, the ideal mathematical representation of energy. Half the spiral's rotation occurs at a point on the cylinder that is one half the height of a complete cycle of rotation.

At right, a spiral on a cone. At one half-rotation, the spiral has reached a height, measured along the central axis of the cone, that is less than one half the height of a complete cycle of rotation. The height of the spiral after making a half-rotation will be the geometric mean (G) between the height at the beginning and end of the cycle of rotation. The arithmetic mean (A), the midpoint of the vertical distance traversed by the total action, is at a point more distant.



losing a war. Hence, it is the unfortunate reality of modern history, that great advances in technology of civilian economies have often been a by-product of mobilization for wars. It is not that war is the indispensable instrument of progress—usually it is not; it is that nations refuse to do what they should have done in pursuit of peace, until the hot breath of war is upon their necks.

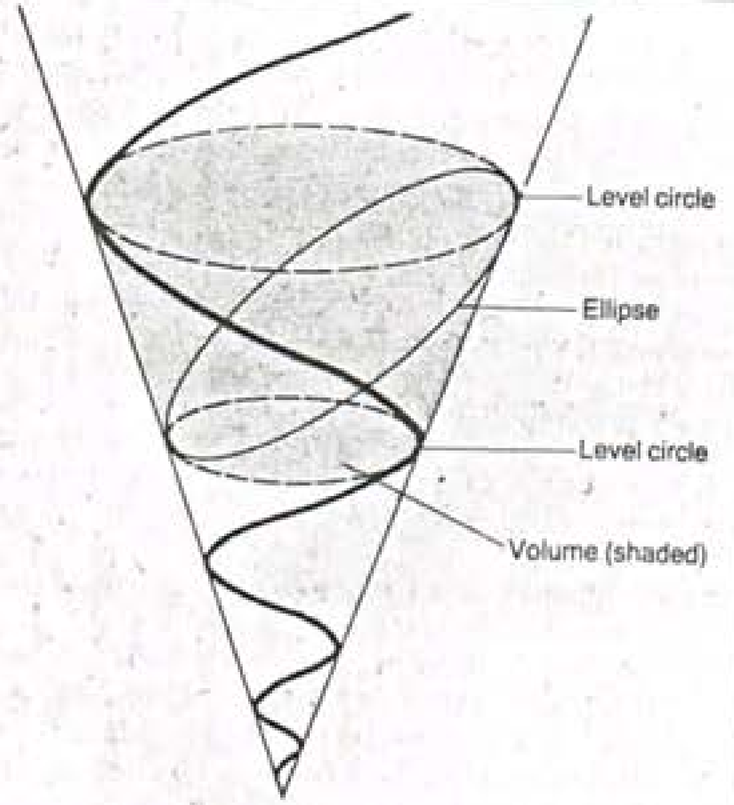


Figure 3
ELLIPSE CHARACTER OF CONICAL ACTION

The path of the spiral up the cone defines the first integral of the complex variable. The shaded area between the two circles represents the volume and defines the second integral, net work. The character of this volume is the ellipse cut between the two level circles.

Technological attrition converges upon the notion of successive scientific revolutions, at least, successive technological revolutions. The distinction between the two is that a technological revolution is a scientific revolution put into practice—too often, belatedly. The idea that there exists a "world-line" based on successively ordered series of scientific breakthroughs, or technological breakthroughs, is the implied feature of technological attrition, and therefore the implied feature of all "crash programs" resembling that which we have proposed. This represents the ideal case for direct application of the third level of hypothesis.

Conical Functions Defined

The fundamental fallacy of the work of Einstein—and many others—was his refusal to accept the fundamental principle upon which the preceding development of European science depended: the treatment of the implications of the five Platonic solids from the vantage point of Cusa's rediscovery of the isoperimetric principle: the principle that the *action of circular rotation*, Leibniz's Principle of Least Action, is the only form of action self-evidently existing in visible (Euclidean) space. All of Einstein's major errors are derived from this consideration, including his misinterpretation of Riemannian physics.

Briefly, circular action in a measureless, formless void, creates a circular area of measureless extent. The repetition of this same action upon that circular area creates the straight line, and also creates the first degree of measure: division of circular rotation by one-half. This is the only definition of a straight line permitted within a rigorous mathematical physics. The same circular action repeated upon a semicircle creates a point. From circular action, and the line and point created by circular action (singularities), all forms constructible in visible (Euclidean) space are constructed, using no other means but the hereditary principle of con-

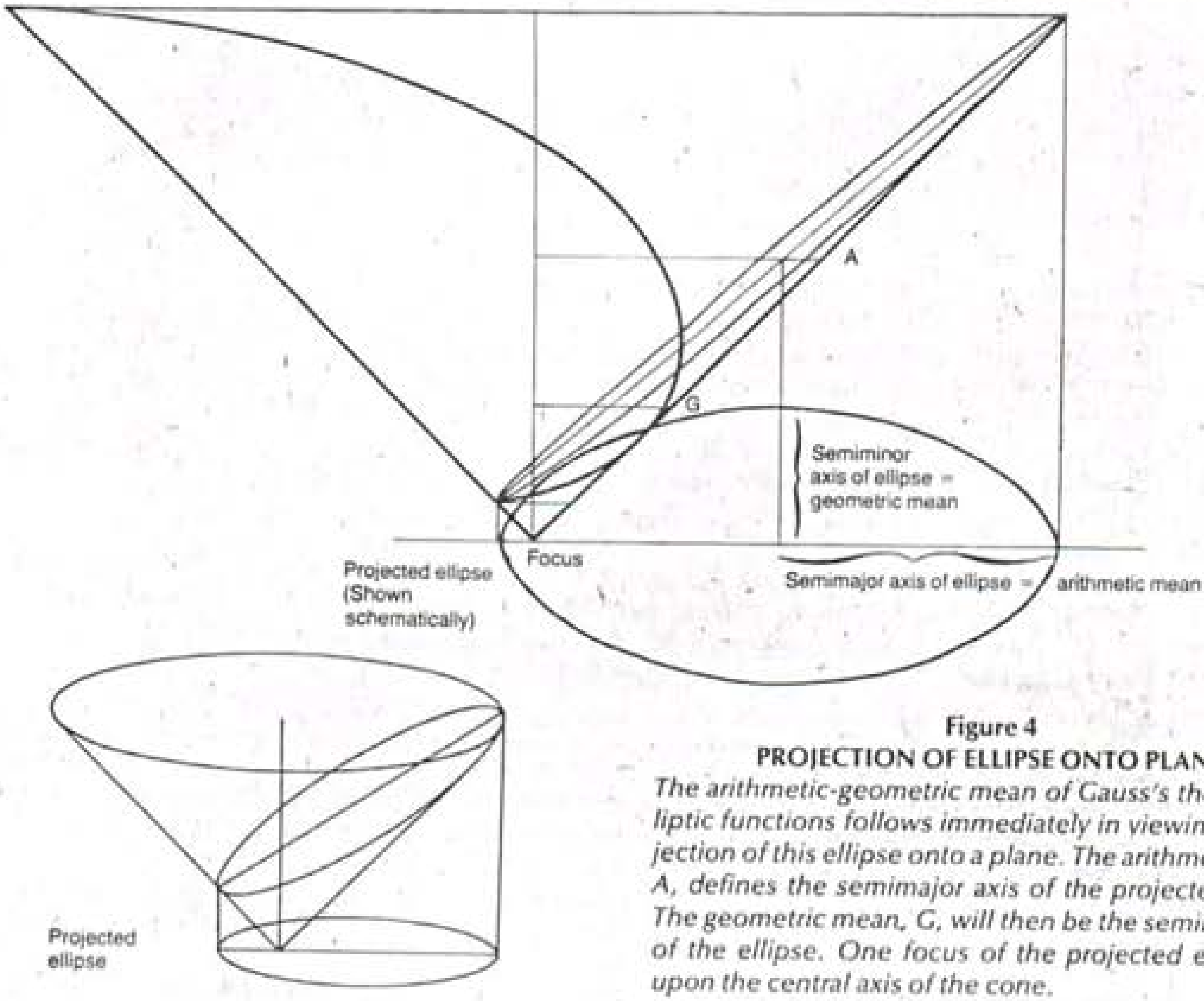

A
G
Semiminor axis of ellipse = geometric mean
Focus
Projected ellipse (Shown schematically)
Semimajor axis of ellipse = arithmetic mean
Projected ellipse

Figure 4
PROJECTION OF ELLIPSE ONTO PLANE
The arithmetic-geometric mean of Gauss's theory of elliptic functions follows immediately in viewing the projection of this ellipse onto a plane. The arithmetic mean, A, defines the semimajor axis of the projected ellipse. The geometric mean, G, will then be the semiminor axis of the ellipse. One focus of the projected ellipse lies upon the central axis of the cone.

struction from the starting-point of circular action. No axioms or postulates are permitted in rigorous mathematical physics, or geometry.

The limitations upon construction in visible space are two. First, only five kinds of regular polyhedra can be constructed in visible space—the five Platonic solids. All of these solids (4, 6, 8, 12, and 20 sides respectively) reduce to one elementary such solid, the 12-sided dodecahedron whose sides are equal, regular pentagons. The pentagon and the dodecahedron are both constructed on the basis of a harmonic characteristic called the golden section. Nothing can be constructed in visible space except by reference to the unique feature of the golden section. The second, ultimately identical limitation, is the fact that certain classes of occurrences within visible space cannot be constructed within visible space, those constructions which depend upon transcendental functions—including the regular heptagon.

However, all existences within visible space can be constructed as projections of continuous, conical functions upon visible space. These conical constructions have the elementary form of a self-similar spiral on the outer surface of a cone. This spiral has the 2-space projection of an Archimedes spiral whose characteristic proportion is the golden section. Each cycle of the spiral defines a circular cross-section of the cone. All existences in visible space are thus defined by transcendental conical functions. *The conical self-similar spiral of the reflected continuous manifold is the only self-evident form of physical action in the universe* (Figure 1).

This is the foundation of all rigorous forms of mathematical physics. This is the elementary root of the third level of hypothesis for mathematical physics.

Pacioli, da Vinci, and Kepler emphasized that all living processes have the morphological characteristics of growth and function of the golden section. *Functions with such characteristics are negentropic functions.*

Kepler proved, and that conclusively, that the Platonic harmonic system, as presented by Plato's *Timaeus*, is the basis for the universal laws of astronomy. With aid of corrections supplied chiefly by Karl Gauss, Kepler's astronomy is valid to the present date, whereas all opposed doctrines are not.

The most fundamental breakthrough in science after Kepler and Leibniz's, was the discovery of the arithmetic-geometric mean by Karl Gauss. Without this discovery, no fundamental discovery of post-1830 European sicence would have been possible (after Legendre, Fourier, and Poncelet). This is what Einstein rejects implicitly.

The most elementary complex variable is the stretching of a rotating radius-line as the radius rotates around the axis of a cone. The simplest case is that in which the radius increases by a fixed ratio as it rotates, such that, after each complete rotation, the radius has increased by the ratio of some fixed number. If the ratio of the radius's increase is "1," the result is a constant spiral on the outer surface of a

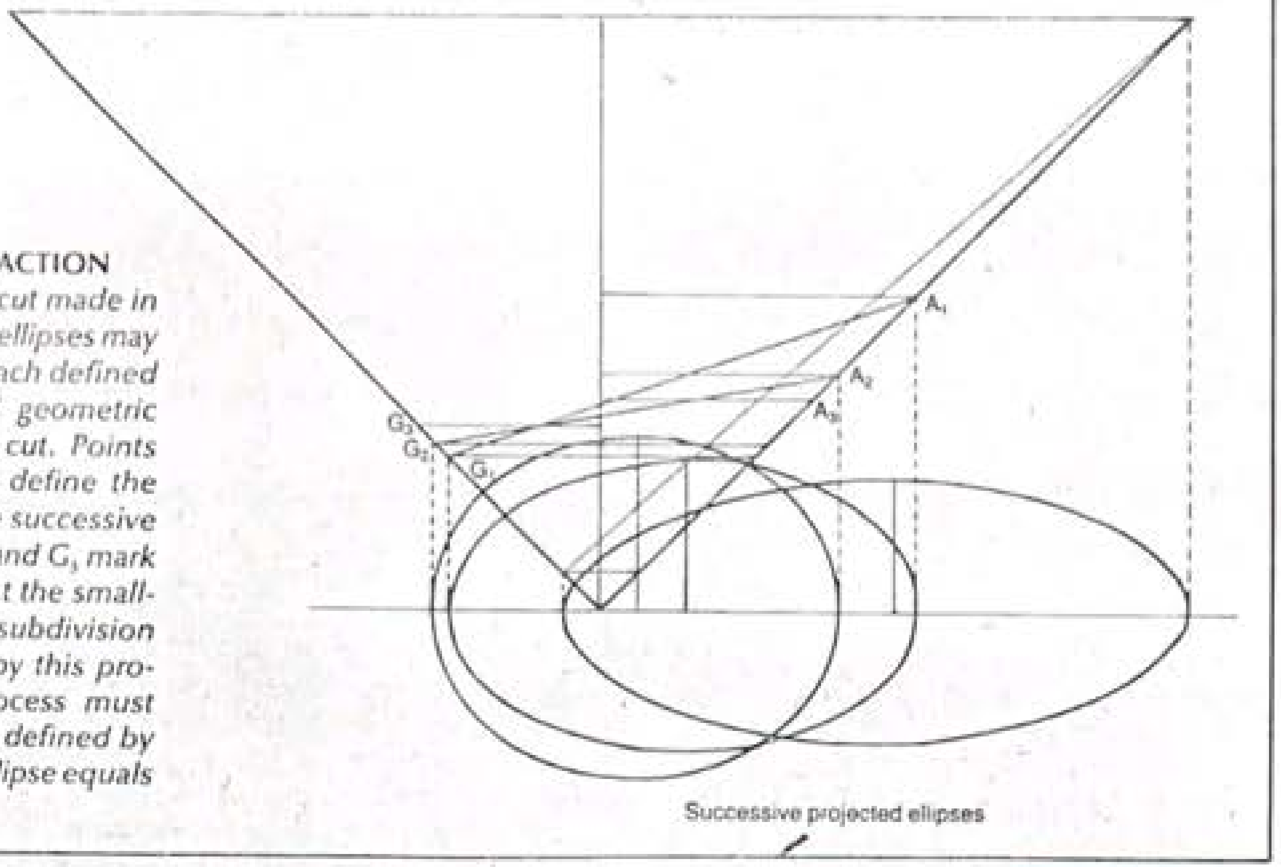


Figure 5
THE QUANTUM OF ACTION
Following the elliptical cut made in Figure 3, a succession of ellipses may be cut from the cone, each defined by the arithmetic and geometric means of the previous cut. Points A_1, A_2, A_3 on the cone define the arithmetic means of the successive ellipses; points G_1, G_2, and G_3 mark the geometric means. At the smallest possible self-similar subdivision of the spiral achieved by this process, the recursive process must stop. Here, the volume defined by the two foci of the last ellipse equals the quantum of action.

cylinder, the ideal representation of *energy*. If the ratio is greater than "1," the result is a self-similar spiral on the outer surface of a cone, the ideal representation of *work* (Figure 2).

In the second case, the Gauss arithmetic-geometric mean follows immediately.

The first integral of such an elementary complex variable the spiral-action (for an interval of time). The second integral (for our purposes here) is the definite integral of the spiral-action for one completed cycle of rotation: the volume defined by two successive circular cross-sections of the cone, at the beginning and end of that cycle. The characteristic of this volume is the ellipse defined by any diagonal cut of the volume by a plane (Figure 3).

If the volume is cylindrical, the spiral rotates half its rotation at the midpoint of the volume: The geometric and arithmetic means are coincident. The elliptical cross-section defines energy, but not work.

If the volume is conical, the spiral rotates less than half the distance along the central axis of the cone during the first half of the rotation. In this case, the geometric mean lies below the arithmetic mean; the two are not coincident.

Imagine the cone standing on a plane and project the boundaries of the spiral down to the plane. The distance between the two points on the plane defines the major axis of an ellipse in the plane. The vertex of the cone forms one focus of this ellipse (the position of the sun in the Earth's orbit). The semimajor axis of the projected ellipse has the same length as the radius of the circle that is located at the arithmetic mean on the cone. The semiminor axis has the length of the radius of the circle located at the geometric mean (Figure 4).

Let us imagine that the ellipse on the plane is projected from an ellispe located in a cone. We can generate a series f similar ellipses, each bounded by the arithmetic and ometric means of the previous ellipse. Repeat this operation a large number of times. The question is: When does one stop this recursive process? This is the kernel of Gauss's theory of elliptic functions.

At whatever point the recursive process ceases, the remaining volume defined by the two foci of the last ellipse defines a degree of rotation of the spiral generating the cone, and also defines a relative value for an interval of displacement along the central axis of the cone. In a universe whose metric is the speed of light, this will correspond to a wavelength, a frequency. If this is determined in some necessary way, we have Leibniz's "delta" and the notion of the quantum of action (Figure 5).

The physical significance of this was first established in available scientific literature, by Riemann's 1854 habilitation dissertation, "On The Hypotheses Which Underlie Geometry." Assume the prior self-elaboration of the universe as a whole, or some phase space to correspond to some well-defined number N, such that the singularity of the Gaussian elliptic-function series for the conical interval represents $N+1$. This means that action corresponding to a well-defined notion of work acts upon the universe (or phase space) as an entirety, such that that action is bounded uniquely, in scope and division of itself, by the relationship implied by values $N+1$ and N. This defines a smallest division of action, below which only a singularity in physical space can occur. That is a quantum of action, a value which varies relativistically as the universe evolves to higher states, or as the phase space evolves similarly.

That is what the quantum represents from the standpoint of the third level of hypothesis: a smallest wavelength of continuous action, below which only a singularity can exist.

This was the basis for Riemannian electrodynamics, in which retarded potential, rather than notions of the statistical theory of heat, is characteristic. This has been the underlying issue of the factional furor within physics for more than a hundred years.

However, this quantum can be measured empirically not only as a smallest wavelength of a continuous (for example, electromagnetic) function. Changes in the value of the quantum, relative to functional notions associated with N and $N+1$, also correspond to relativistic metrical changes in the characteristic rates of action within the phase space concerned, as Riemann specifies. This, from the standpoint, again, of the third level of hypothesis, defines relativistic physics.

Contrast to Newton and Maxwell

Any system for describing physical processes which is modeled upon the syllogistic system of Aristotle, eliminates representation of such forms of action as "create" and "cause" within the mathematical system itself. The use of the equal-sign or inequality-signs has the same function as the middle term in the Aristotelian syllogism. Hence, mathematics usually confronts us with the ludicrous spectacle that we speak of creation of the universe, and speak of and observe causal relationships in physical processes, but can find no expression of either in conventional mathematical schemas.

The paradox does not exist in a rigorous geometry of the sort we have indicated here. Circular action, as the mirror of conical-self-similar action, is the form of the verb "to create," and also the description of action congruent with the verb "to cause." Creation and causation are one and the same, at least essentially. This requires, of course, that we cast aside all of the axioms and postulates of Euclid's *Elements*, or anything resembling them, and replace entirely the syllogistic lattice-work of deductive theorems by the "hereditary principle" of rigorous construction of synthetic geometry from the unique principle of circular (conical self-similar) action, Leibniz's Principle of Least Action.

Most of the formal fallacies which afflict mathematics and mathematical physics are derived not from physical experiments as such, but from substituting an axiomatically algebraic mathematical structure used to describe physical processes for those processes themselves. In a word, *nominalism*. Since such mathematics does not tolerate the existence of a creation, such as our universe, and prohibits specification of causation as a term of description, it should not be surprising that such mathematics is often inappropriate means for studying principles of causation in a created, existing universe. Such mathematics has merit as a language of description, but it is a fool's enterprise to attempt to wring out of such mathematics any evidence bearing upon causation: one would have better luck attempting to wring blood from a stone. When one uses such a language of mathematical description, one must be aware at all points of what this mathematics can and cannot accomplish, and not employ it for the sort of analysis which it prohibits on axiomatic principle.

The same general problem arises in connection with notions of probability. The same word, probability, has mutually exclusive meanings from the standpoint of Gauss on the one side, and Descartes or LaPlace on the other. In Gauss, it signifies the necessarily determined division of action according to principles of a conically defined continuous manifold. In LaPlace, it has a mechanistic-numerological interpretation. In the latter connection, we locate the intrinsic fallacies of assumption underlying popularized notions of a statistical theory of heat, and of related notions of statistical dynamics, quantum mechanics. There is no doubt that the action described probabilistically occurs as a phenomenon in more or less the form described. The issue is that of what sort of causal notion one might wring out of the two, mutually exclusive modes of description—Gauss's versus LaPlace's, for example. The latter prohibits incorporation of causation into mathematics: Lo and behold! Such mathematics argues from examining its own probable navel, that causation does not exist!

Admittedly, the sort of notions we have described for the third level of hypothesis do not provide us an elaborated physics. They provide only what that level of hypothesis is defined as providing: principles of discovery. However, the process of experimental refinement of such principles of discovery converges upon the underlying principles of lawfuness of the universe in general, and thus constitutes as much as we can know respecting the fundamental laws of that universe. Not only does this level of hypothesis define a *method*, it also defines as much as we can know respecting the lawful *ontology* of the universe as a whole. Not only is science fundamentally *methodologically transfinite*; the universe explored is itself *ontologically transfinite*.

This addresses an issue which much occupied German science at the beginning of this century, a shift from the ontologically transfinite standpoint of Cusa, Kepler, Leibniz, Gauss, Riemann, et al., to the only-methodologically-transfinite approach of German science at the turn of the century. This latter represented a limited concession to Helmholtz, Boltzman, et al., the leading enemies, together with Maxwell, Rayleigh, et al., of the rigorously geometrical approach to physics. The geometrical method was degraded from a method of physics, to a method for clever intuitions into matters bearing upon the interpretation of mathematical physics' problems.

The legitimate problem, which the purveyor of statistical mechanics cites against the mechanistic system of Descartes and Newton, is that action in the universe does not conform to the notions of one-on-one interactions among isolated particles in empty space. There are determinations which belong to the manifold as a whole, which override what might appear to be inferred from a mechanistic misinterpretation of space. Probability appears to fill the gap between the two, and, within limits, appears to provide an efficient guide to practice in those matters for which the mechanistic method fails otherwise.

The fallacies intrinsic to statistical mechanics generally, and quantum mechanics in particular, are, therefore, these.

(1) It overlooks the fact that physical reality cannot be constructed within visible space, but that this reality can be constructed only as projections of a continuous manifold upon the discrete manifold of visible space. Our sense-perceptual apparatus is such, that we distort the real universe (the continuous manifold) into the form of the visible (discrete) manifold of sense-perception. The result is as if a distorting mirror were everywhere embedded in space, such that we see only the distorted reflection, not that which is reflected. Therefore all inductive-empiricist method is in-

trinsically false as to principled features of the cause of phenomena.

(2) It assumes that least action is straight-line action as defined by a naive view of the discrete manifold as self-evidentally reality, whereas the only real form of action in the universe is least action defined by the projection of self-similar-spiral conical action as the isoperimetric principle of visible space. Thus, mathematical physics is made intrinsically incommensurable with the action causing the phenomena.

(3) It makes energy and work simply equivalent, and ignores the fact that all action is essentially negentropic work, congruent in principle with increase in the areas of conical cross-sectional circles defined by a self-similar, harmonic conical function. *It confuses mere effects with work*, and therefore distinguishes entropy and negentropy as a mere construct of such effects, rather than properly recognizing that effects are singularities of negentropic or entropic action as primary realities.

These problems vanish once the successive standpoints of Gauss and Riemann are adopted.

This does not signify that we can derive physics simply and directly from the third level of hypothesis. It is merely a method for effecting improvements in physics, and also for judging what is outrightly absurd in existing physics' doctrines respecting fundamental matters. It is simply a rigorous way of thinking about the universe, which means that a physicist employing such rigor is vastly superior to one of equal training lacking such rigor.

Economics and Physics

Popular opinion is so much conditioned to confusing economics with monetary doctrines, that the connection of economics to physics is simply overlooked or violently denied. It is forgotten that modern economic science was founded by Leibniz, who defined economics as "physical economy," as did the founding fathers of the United States (for example, Hamilton's *Report On the Subject of Manufactures*).

What we measure, ultimately, in economy, is the relative increase or decrease of the power of a population to sustain its own existence. This is best described as the potential relative population-density of a society (economy). This measures man's per capita power over nature, and thus defines what changes in behavior correspond to an increase or decrease in man's knowledge of the lawful ordering of the universe.

Those changes in behavior which overcome effects of depletion of natural resources, or which advance mankind's potential relative population-density absolutely, are increases in technology. Thus, the net work accomplished by society is properly defined as the role of work in mediating advances in technology for the practice of the society as a whole. This form of work is intrinsically negentropic, corresponding to the simplest sort of ideal conical function indicated above. That is our proper definition of work, and the proper measure of technology's equivalence to work. This connection was the discovery the writer effected in 1952 on the basis of implications of Riemann's 1854 habilitation dissertation.

In other words, increase of the potential relative population-density of an economy is the unique experimental authority for determining what are in fact valid scientific conceptions. Any purportedly scientific notion which contradicts such criteria is ipso facto scientific absurdity. Any notion, however correct, which cannot account for itself in these terms of reference, is to that degree scientifically illiterate.

This was understood by Leibniz, who developed thermodynamics from the vantage point of his development of economic science: his generalization of the implications of the heat-powered machine for increasing the power of an individual operative to perform work. The fact that two machines, consuming the same amount of coal per hour, contribute differently to an operative's power to accomplish work, is the basis for the notion of technology.

Technology, in turn, reduces, in the case of machines, to the Principle of Least Action: conical functions as we have indicated here. This is generalized for electromagnetic action. Although we have failed to solve this for chemistry and biology, the terms of mechanical and electromagnetic work-action have proven adequate even for biological processes. Today, we reduce the formal aspect of technology to electromagnetic equivalents, and measure increase in productive power per capita in such electromagnetic-geometrical terms of reference for measuring technology.

By correlating technology so defined with the work represented as increase of potential relative population-density, we correlate technology with economic growth, the latter properly defined. Thus, we prove that those principles of discovery generating successive scientific revolutions are consistent with man's increase of per capita power over the universe. That is the ultimate scientific experiment, upon which the authority of all scientific knowledge ultimately depends.

There is much talk of the function of morality in science, a matter which was of great concern to Einstein, but a conception which eluded his grasp, and which thus misled him and his associates into many immoral directions. Reason and love are inseparable qualities of the Logos. A love of reason (the Logos) expresses itself as a love for the improvement of the condition of mankind through technological progress, and a love for that potentiality within each human personality which corresponds to the power to develop, assimilate, and apply technological progress. This is loved not merely because it enables mankind to improve his material conditions of life, but because this improvement relies upon the development of those powers of the human individual which converge upon agreement with the Logos, with the divine.

The problem of Albert Einstein, in matters of science, is that he fell in with such political company as the most evil man of the 20th century, the late Bertrand Russell, as did the "Dr. Strangelove" of the Pugwash Conference, Leo Szilard.

Lyndon H. LaRouche, Jr., an economist, is a member of the board of directors of the Fusion Energy Foundation. He is currently a candidate for the Democratic Party presidential nomination.

Bedini Electronics
13410 Sayre Street
Sylmar, Cal. 91342

Attn: External Submissions

May 10, 1985

To whom it may concern:

The HYPERCUBE Speaker Enclosure was discovered as a result of research into the construction of four-dimensional structures. Objects occupying four dimensions must be constructed of four-dimensional materials; sound is four-dimensional in nature. When hypercubes were made from sound it was noticed that the clarity and overall sonic quality of music played through them was greatly enhanced - and the HYPERCUBE Speaker was born. These speaker enclosures fly in the face of conventional audio theory, but they have been demonstrated to work very well indeed.

Licenses to manufacture the Hypercube Speaker Enclosure are now available. This enclosure represents a major breakthrough in quality sound reproduction. The efficiency, frequency response, and transient response of any dynamic driver are dramatically improved when coupled with the HYPERCUBE Speaker enclosure. These are not "paper improvements" measurable only with sophisticated instruments; rather they are obvious, audible improvements immediately apparent to the consumer in the dealer's showroom.

Enclosed are copies of the patent sans claims and an engineering report concerning the relative performance of a JBL L-40 speaker system and the same drivers and crossover coupled with the HYPERCUBE speaker enclosure. Software helpful in the design of HYPERCUBE speaker enclosures for any size driver is available from Tesserax upon request. This software runs on an IBM-PC with a color graphics card and at least 128K memory. A version of this software that allows operation with a monochrome adapter and monitor is presently being developed and will be available soon.

The ideal material for these enclosures is injection-molded DuPont Rynite-545. However very good results have been obtained with 1/8" aluminum sheet. 1/8" gum plywood works well if the driver size is 8" or less. The material used must be both THIN and RIGID. NO ACOUSTIC DAMPING MATERIALS OF ANY KIND ARE USED WITH THIS ENCLOSURE!

If you have any questions concerning these enclosures please contact us at our address or the phone number below. Thank you.

Very truly yours,

Thomas R Weiss

Thomas R. Weiss
Tesserax, Inc.
P.O. Box 1177
Crystal River, Fl 32629
(904) 795-2326

United States Patent [19]

Weiss et al.

[11] **4,231,446**

[45] **Nov. 4, 1980**

[54] **RESONATING CHAMBER**

[75] Inventors: **Thomas R. Weiss; Matthew R. Kennedy,** both of Crystal River, Fla.

[73] Assignee: **Tesserax Inc.,** Homosassa Springs, Fla.

[21] Appl. No.: **26,443**

[22] Filed: **Apr. 2, 1979**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 876,012, Feb. 8, 1978, abandoned.

[51] **Int. Cl.**^{3} **H05K 8/00**
[52] **U.S. Cl.** **181/148;** 181/199
[58] **Field of Search** .... 181/148–156, 181/198, 199; 179/1 E; D14/33

[56] **References Cited**

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D. 226,567	3/1973	Sioles	D14/33

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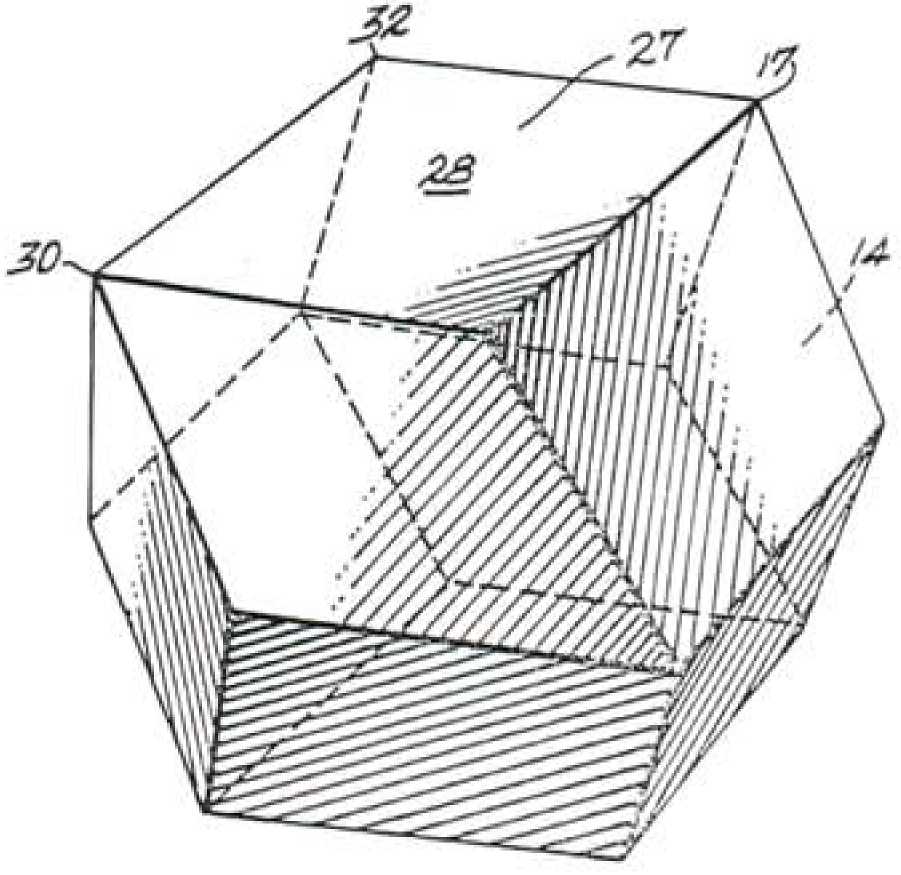
Audio Engineering, vol. 35, No. 11, Nov. 1951, pp. 34,36,38,59–64, Olson, H. F., "Direct Radiator Loudspeaker Enclosure".

Primary Examiner—L. T. Hix
Assistant Examiner—Benjamin R. Fuller
Attorney, Agent, or Firm—William A. Newton

[57] **ABSTRACT**

An acoustical reproducing apparatus is disclosed for high fidelity sound reproduction comprising a speaker unit in combination with a cabinet enclosure acting as a resonating chamber. The resonating chamber has a rhombic dodecahedron configuration having speaker-mounting openings located on two or more opposed rhombi, or with one or more corner thereof being truncated and terminated in a baffle plate having an opening for mounting the speaker unit, or with one or more elongated or shortened zone and provided with either of the foregoing means of mounting speaker units. The resonating chamber includes a plurality of rhombus-shaped and/or parallelogram-shaped panels.

14 Claims, 11 Drawing Figures



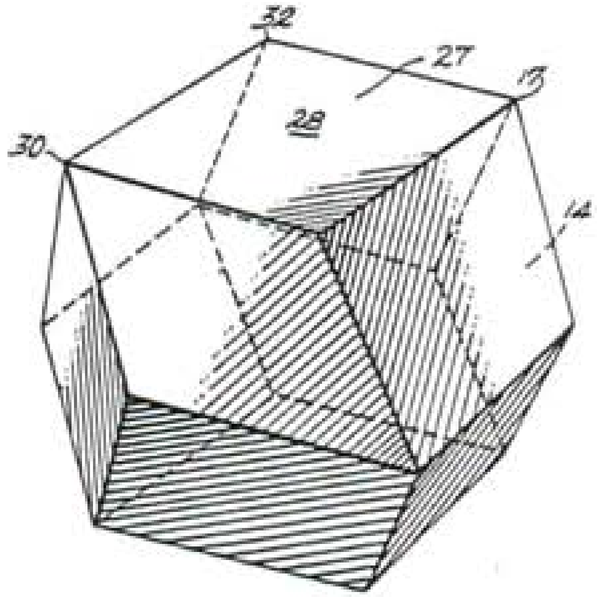


Fig. 1

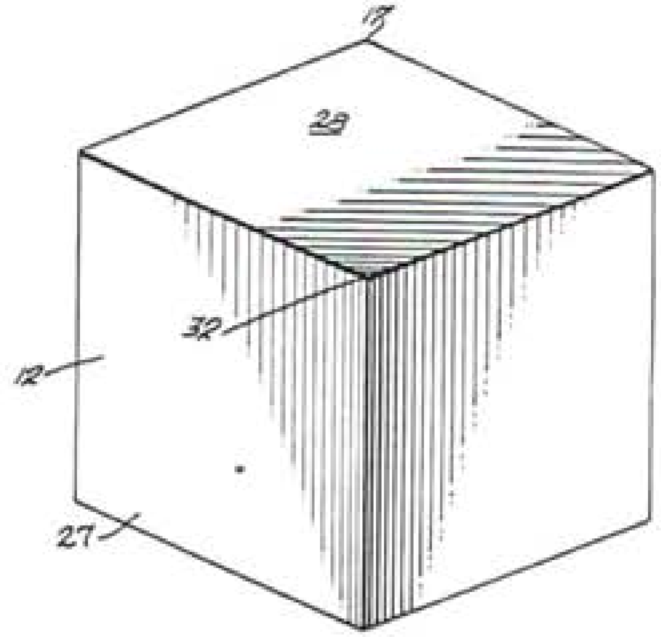


Fig. 2

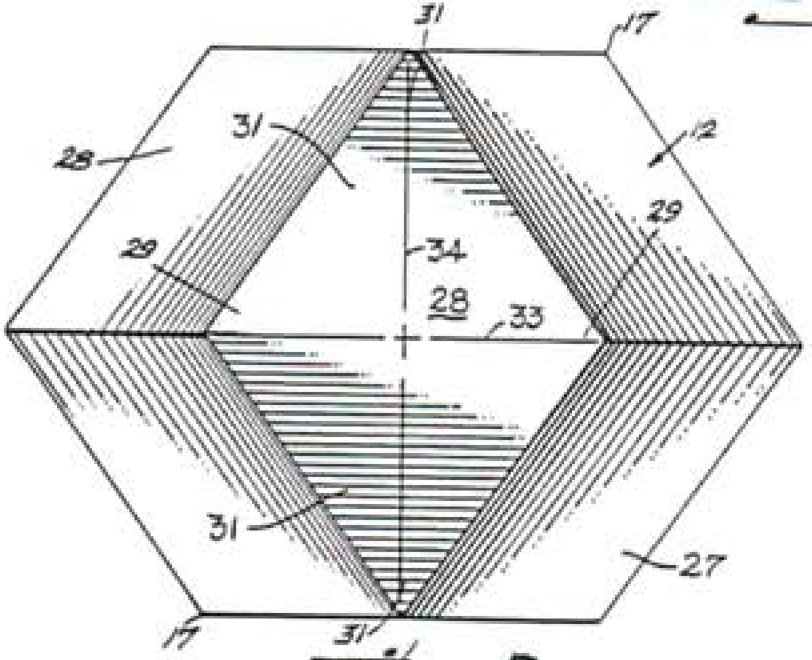


Fig. 3

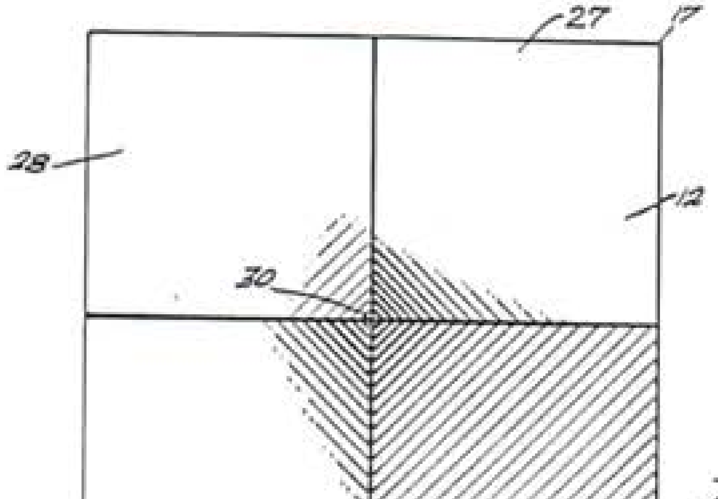


Fig. 4

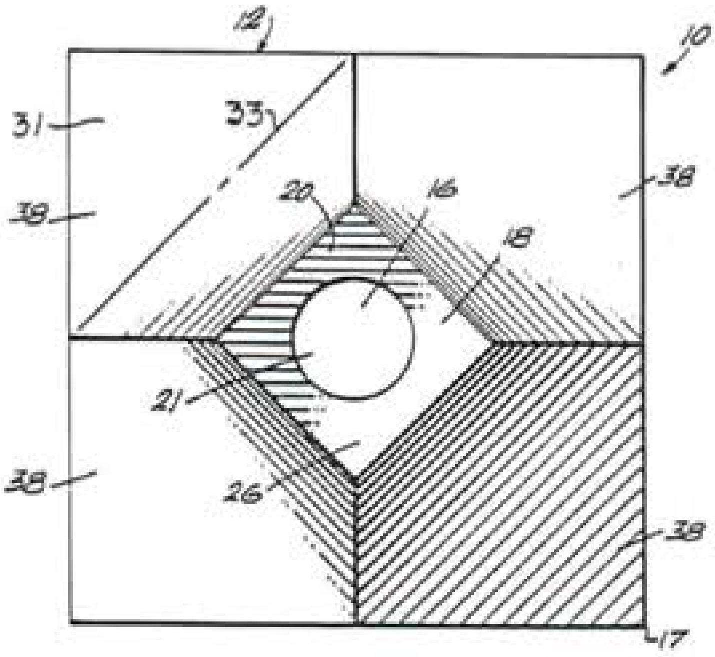


Fig. 5

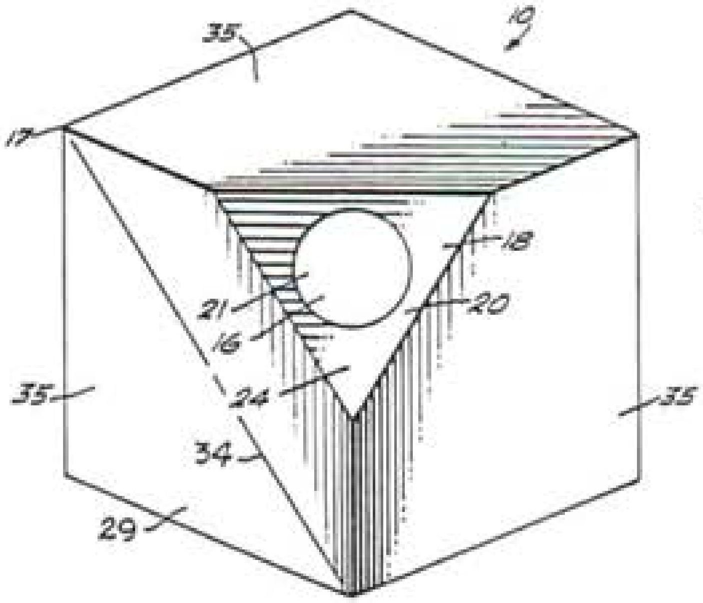


Fig. 6

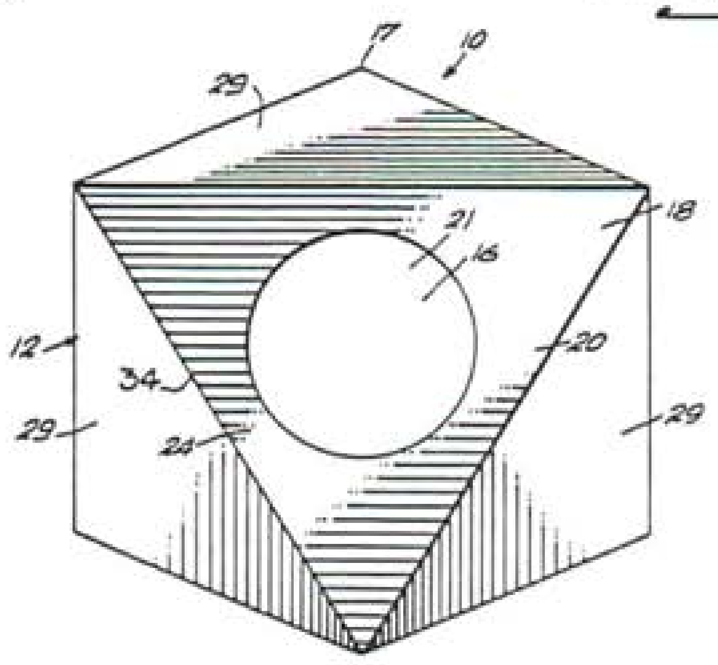


Fig. 7

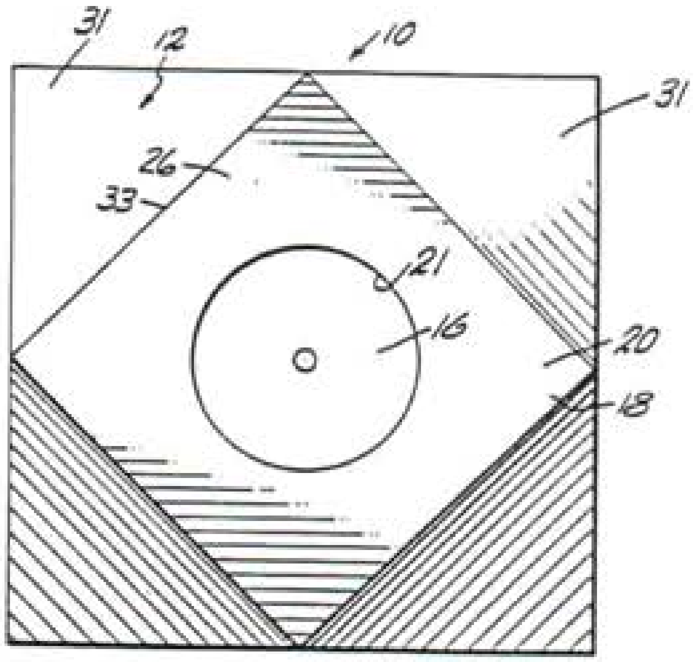


Fig. 8

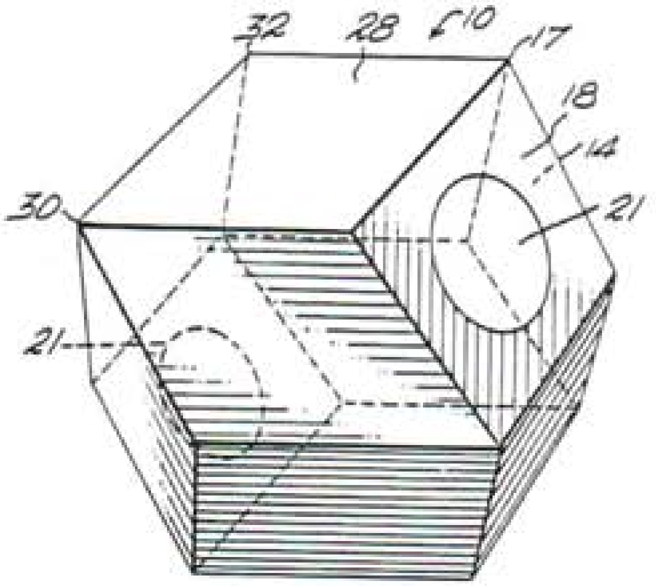


Fig. 9

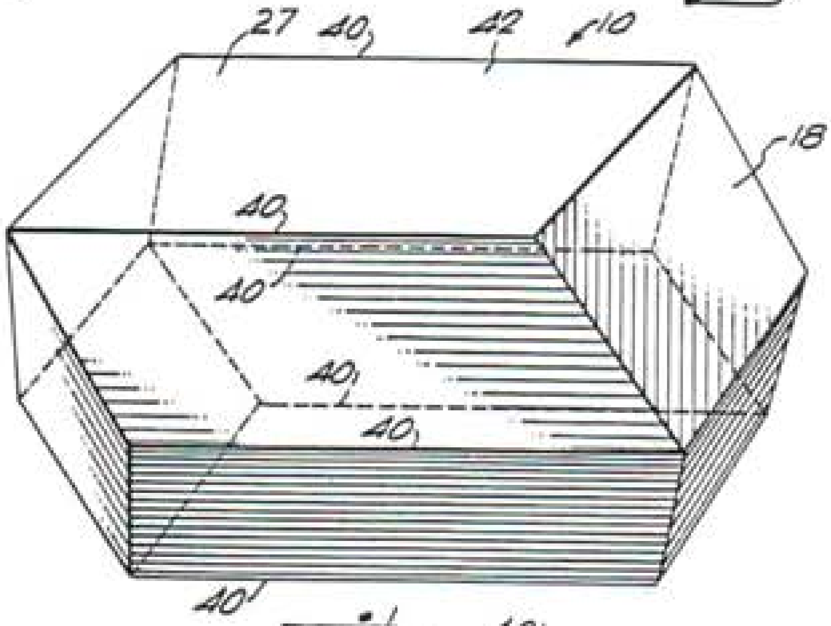


Fig. 10

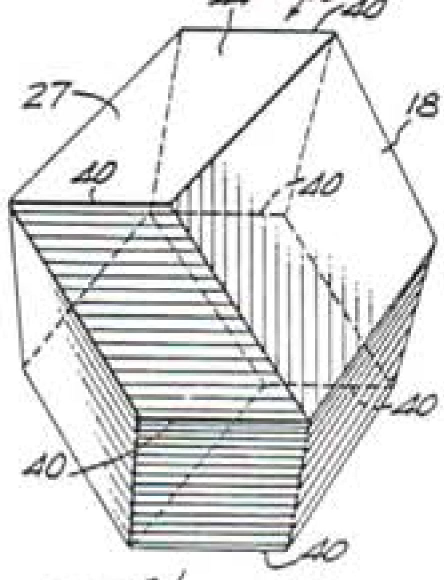


Fig. 11

RESONATING CHAMBER

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of an earlier filed application, Ser. No. 876,012, filed on Feb. 8, 1978 now abandoned.

FIELD OF THE INVENTION

The present invention relates to sound reproducing devices, and more specifically to the speaker enclosure for a speaker unit.

DESCRIPTION OF THE PRIOR ART

As is common knowledge, a speaker is an electromechanical device for converting a varying audio voltage into corresponding sound waves. Despite all the care taken in attempting to preserve the fidelity of an audio signal from the pickup to the output of an amplifier, the most expensive speakers with their associated speaker enclosures existing in the prior art invariably add a substantial amount of distortion to the signal. In other words, normally, even the most expensive speaker-enclosure systems of the prior art do not have the audio frequency response of the quality of its associated amplifier. The hi-fi and stereo industry in its attempt to decrease the gap in the accuracy and frequency response between the speaker-enclosure systems and the corresponding amplifier have developed speakers of increasing quality and expense, but have had limited success in closing the gap. More specifically, the industry has fervently researched and improved the design of the drivers (Cones, etc.) but have not significantly improved the enclosure or resonant cavity to which these drivers are coupled. The prior art has failed to develop a speaker enclosure sufficiently superior to the rectangular box-like enclosure and has not been successful in resorting to new geometrical configurations to eliminate the hereinafter described problems with speaker enclosures.

It should be noted at this point that the main goal of the hi-fi industry is to perform the conversion of audio voltages to density waves of audible frequency and amplitude in a manner that minimizes the distortion while maximizing the "liveliness" or "life-like" character of the reproduced sound. The former is a measurable physical characteristic, while the latter is a complex psycho-acoustical quality subject to individual taste and preferences. It should be further noted that the present invention claims as advantages improvement in minimizing the amount of distortion, improving efficiency by utilizing the energy of the backwave, and improving the "presence" character of the sound by the omnidirectional propagation of a broad wave front of low curvature, particularly in the important middle ranges, and improving the frequency response of speakers by minimizing backwave interference, all of which are inherent in the design configuration of the speaker enclosure, and is not directed to improvement in the "liveliness" character of the reproduced sound, which is merely a design preference.

A primary problem with the poor frequency response of the speaker-enclosure has been that the sound which is heard from the speaker is produced by a combination of the speaker and its enclosure. More specifically, the speaker radiates sound from both the front and the rear of the speaker cone. In other words, as the speaker cone

moves forward the air or atmosphere in front of the cone is compressed and simultaneously the forward motion of the cone causes a rarefication of the air along the back surface of the cone. On the reverse or backward movement of the cone, this action is reversed and the air in front of the cone is rarefied while the air behind the cone is simultaneously compressed. This leads to a situation where the sound in the front of the speaker or the front wave, as opposed to the sound behind the speaker, or back wave, is 180° out of phase relative to the other. The most significant problem with this backwave is that it reflects from the back panel or other surfaces of the prior art box enclosures into the back surface of the speaker cone and causes distortion by interfering with its mechanical movement. The distortion is of the "flubby" type which destroys crispness and generally deteriorates the quality of the sound. Further, if vented to the exterior, it joins with the front wave but is out of phase with it at most frequencies and causes interference patterns, including cancellation and reinforcement, within the listening area.

In the schemes of the prior art which attempt to overcome the well-known problems of the back sound waves, various obstacles have been incorporated into the enclosure to attempt to eliminate the back-wave interference. More specifically, a rear back panel, lying in a perpendicular plane to the center axis of the speaker cone, has been provided with padding of various sound-absorbing materials, attempting to dampen out and absorb the back-wave. Also, various geometric configurations have been attempted to eliminate or reroute the back-wave. Additionally, by making the length from the rear of the speaker to the back rear wall a certain predetermined distance, some prior art devices have attempted to make the reflected wave from the back rear wall to be in phase with the front wave, and thereby reinforcing the front wave. However, due to the wide range of frequencies, sometimes ranging from 30 CPS to 20,000 CPS, this reinforcing technique has proven impractical. The following are patent references which show the various prior art devices that incorporate the above-described prior art constructions: U.S. Pat. Nos. 2,315,896; 2,806,546; 2,825,419; 2,839,150; 2,866,517; 2,926,740; 3,412,824; 3,523,589; 3,578,103; 3,771,621; 3,885,326; 4,044,855; 3,923,124; 3,235,028; 3,627,948; 4,033,430; French Pat. Nos. 1,152,660; 2,858,899; 2,975,852; 3,186,509; 3,912,866; 2,206,012; 2,337,213; 2,787,332; 2,805,729; 2,806,547; 3,203,502; 3,578,103; 3,929,124; Italian Pat. No. 569,952; French Pat. No. 639,302, British Pat. No. 848,427, Des. 225,865 and Des. 226,567.

The normal box-like speaker enclosures of the prior art generally radiates sound in a cone-shaped pattern from the front panel. When two such enclosures are combined in spaced apart relationship, as is the typical practice, the directional radiation of sound creates a "hole" between the two sources. Speaker placement and acoustic environment become critical factors, and stereo image is hindered.

With the above described separated stereo pair, when two or more wave fronts converge they form a "resultant" wave front of lesser curvature than any of them. The quality of "presence" lies in the shape of the external wave front reaching the ears of the listener. This advantage somewhat depends on the ability of the ear to analyze the curvature of a wave front—near or far, big or little. For example, an orchestra puts out a broad wave front from a wide area together with reverberations from the surrounding acoustic chamber, and the audience hears this as "presence." When the sound is recorded and then reproduced in the box-speaker enclosure of the prior art, the "presence" is lost and the listener knows very well that the sound is being beamed at him from a small source.

In summary, the schemes of the prior art have failed to improve the cabinet or enclosure of the speakers to effectively eliminate the back wave problem, and therefore the industry has turned to expensive improvements of the speaker itself, with limited success in eliminating distortion.

SUMMARY OF THE INVENTION

The present invention is directed toward an acoustical reproducing apparatus for reproduction of sound vibrations with a maximum degree of fidelity comprising a speaker unit in combination with a cabinet enclosure having defined interiorly therein a resonating chamber. The resonating chamber has an essentially rhombic dodecahedron configuration having two or more opposed rhombi with speaker openings, or with one or more corners thereof truncated and terminated with a baffle plate having an opening therein for mounting a speaker unit, and/or having one or more zones elongated or shortened and provided with either or both means of speaker mounting.

It is an object of the present invention to provide a speaker enclosure which allows the speaker to perform over a wide frequency range with a minimum of distortion. More specifically, it is an object to provide a speaker cabinet which allows for low and high sound frequencies to be reproduced with a high order of efficiency and fidelity and wherein distortion commonly encountered with the prior art speaker enclosures is reduced, minimized or eliminated.

A further more detailed object of the present invention is to provide a speaker enclosure which allows for a substantial increase in the frequency range in which acoustical reproduction can occur with minimum distortion.

A more detailed object of the present invention is to provide a speaker enclosure which minimizes the interference of the backwave with the action of the speaker.

A further more detailed object of the present invention is to provide a speaker enclosure which seals in the back wave and utilizes its energy to propagate sound from the relatively large surface area of the enclosure.

A further more detailed object of the present invention is to provide a speaker enclosure which improves the quality of the sound by sealing in the back wave so that it is not emitted out of phase so as to cause interference with the front wave.

Yet another object of the present invention is to provide a speaker enclosure which improves the "presence" character of the sound by the omnidirectional propagation of a broad wave front of low curvature.

A related object of the present invention is to provide a speaker enclosure in which speaker placement and acoustic environment with a widely separated stereo pair of such speaker enclosures cease to be critical factors and stereo image is significantly improved.

Another object of the present invention is to provide a novel speaker enclosure in which low, medium and high frequency ranges of sound are faithfully reproduced with a high degree of fidelity so that less expensive speaker units can be incorporated therein without sacrificing the quality of sound.

A related more specific object of the present invention is to provide a speaker enclosure in which there is no "boominess" or distortion of the tones reproduced over a very wide frequency range.

A related more specific object of the present invention is to provide a speaker enclosure in which it is unnecessary to try to achieve "zero resonance" in the design by means of massive construction and dampers, such as tar.

Yet another related object of the present invention is to provide a speaker enclosure which improves the efficiency of the speaker unit.

In summary, it is the object of the present invention to provide a speaker enclosure which (1) minimizes the amount of distortion, (2) improves efficiency by utilizing the energy of the backwave, (3) improves the "presence" character of the sound by the omnidirectional propagation of a broad wave front of low curvature, and (4) improves the frequency response of speakers by minimizing backwave interference; all of which are inherent in the design configuration of the speaker enclosure of the present invention and not directed toward mere design preferences, such as the "liveliness" character of the reproduced sound, and not directed toward being an "ornamental" design.

BRIEF DESCRIPTION OF THE DRAWINGS

Further objects and advantages of the present invention will become apparent as the following description proceeds, taken in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective view of the present invention showing the resonating chamber 14 having a shape or configuration of a rhombic dodecahedron, without one of the corners being truncated and therefore not including the speaker unit.

FIG. 2 is a view of the rhombic dodecahedron cabinet enclosure as viewed from a direction which provides a cube view of the same.

FIG. 3 is a view of the rhombic dodechedron shaped cabinet enclosure as viewed from a direction which is a WUNDT prism view.

FIG. 4 is a view of the rhombic dodechedron shaped cabinet enclosure from yet another direction which provides a four panel geometric image.

FIG. 5 shows the view of FIG. 4 with one of the corners of the speaker enclosure being truncated for the mounting of a baffle and speaker unit.

FIG. 6 shows the view of FIG. 2 with one of the corners being truncated to provide for the mounting of a baffle and speaker unit.

FIG. 7 shows the view of FIG. 2 with one of the corners being truncated along the major axis of three of the rhombis-shaped panels so as to provide a mounting for a baffle and speaker unit.

FIG. 8 shows the view of FIG. 4 with one of the corners of the speaker enclosure having a maximum truncation for mounting a baffle and speaker unit.

FIG. 9 shows an embodiment with maximum speaker openings on opposed rhombi of the configuration of FIG. 1.

FIG. 10 shows an embodiment with an elongated zone with respect to the configuration of FIG. 1.

FIG. 11 shows an embodiment with a shortened zone with respect to the configuration of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

An acoustical reproducing apparatus, generally identified and represented by the reference numeral **10**, has a configuration which is illustrated, partially by a dotted outline, in FIG. **1**. As shown in FIGS. **5–7** the acoustical reproducing apparatus **10** comprises a cabinet enclosure **12** and speaker means **16** in the form of a conventional speaker unit which can be of any type well known in the art. The cabinet enclosure **12** has formed therein a resonating chamber **14**, the specific configuration of the same being where the present invention resides.

As illustrated in the embodiment of FIG. **5**, the resonating chamber **14** has the shape or configuration of a rhombic dodecahedron with a truncated corner **18** being formed into a baffle plate **20**. The baffle plate **20** has an opening **21**, wherein the speaker unit **16** is mounted. The means and manner of mounting the speaker units **16** to the baffle plate **20** is accomplished in a conventional manner.

In the embodiment of FIG. **5**, before one or more corners are truncated, the cabinet enclosure **12** comprises the above mentioned rhombic dodecahedron configuration. More specifically, a rhombic dodecahedron, a geometric description known in other arts but not in the subject art, comprises twelve rhombi. Each rhombus has a pair of opposed 70° corner angles and a pair of opposed 110° corner angles. Each of the rhombi lies in a plane that forms a 120° angle with the adjacent rhombi. This angle is normally referred to as the dihedral angle. Each rhombus has a major axis which bisects the pair of opposed 70° corner angles, and a minor axis which bisects the pair of opposed 110° corner angles. Moreover, each of the four sides of each of the rhombi adjoins one of the sides of another of the rhombi. This particular geometric configuration is particularly hard to draw in a single view and have a meaningful representation. Generally, as is well known in the art, the rhombic dodecahedron has three general geometric two-dimensional views. As shown in FIG. **2**, the rhombic dodecahedron has a cube view, and when viewed this way, the complete rhombic dodecahedron comprises four tri-panels, each tri-panel comprising the three panels visible in FIG. **2**. Likewise, when viewing the rhombic dodecahedron from another direction, as depicted in FIG. **3**, the five panel view generally known as the WUNDT prism is visible. Moreover, when viewing the rhombic dodecahedron from yet another direction as illustrated in FIG. **4**, the same provides a four panel geometric image.

Applying the well-known geometric descriptions of the preceeding paragraph, the cabinet enclosure **12** of the embodiment of FIG. **5** comprises a plurality of rhombus-shaped panels **28**. For the purpose of defining and claiming the present invention, each of the rhombus-shaped panels **28** will be generically described as being a parallelogram-shaped panel **27**. More specifically, the parallelogram-shaped panels **27** of FIG. **1** are a geometric special case wherein all sides are dimensionally equal, thereby defining the rhombus-shaped panels **28**. Hereinafter, other embodiments will have parallelogram-shaped panels **27** which only have opposed sides which are dimensionally equal. All the parallelogram-shaped **27** have in common the heretofore described pair of opposed 70° corner angles and the pair of opposed 110° corner angles. For the purposes of describing the invention, the rhombic dodecahedron shaped resonating chamber **14** is defined to have a plurality of corners **17**. Each of the corners is defined by the joinder of either three or four of the rhombus-shaped panels **28**. More specifically, in the rhombic dodecahedron shaped resonating chamber **14**, the rhombus-shaped panels either meet to define four edged corners **30** or three edged corners **32**. The four edged corners **30** are formed by the joinder of substantially half of each of the four rhombus-shaped panels **28**, taken along the minor axis **33** of the same, while the three edged corners **32** are formed by the joinder of substantially half of each of the three rhombus-shaped panels **28** taken along the major axis **34** of the same. Therefore, defining each rhombus-shaped panel **28** to have two integral half rhombus portions **29** along the major axis **34** and two integral half rhombus portions **31** along the minor axis **33**, it can be seen that each half rhombus portion **29** and **31** contributes to the formation of a corner **17**.

In the embodiments of FIGS. **5** through **8**, for the purposes of mounting the speaker unit **16** in the resonating chamber **14**, one or more corners of the rhombic dodecahedron configuration are truncated to form one or more truncated corners **18**. As illustrated in FIGS. **5–8**, there are several ways in which to create a truncated corner **18** of the resonating chamber **14** so as to provide the increase in sound fidelity of the present invention. A corner is truncated to provide a mounting place for speaker unit **16**, and this truncated corner can be either a four-edged corner **30**, or a three-edged corner **32**. In a pyramid truncation illustrated in FIG. **5**, a four-edged corner **30** is truncated so as to allow the truncated corner **18** to terminate in a quadrilateral, and more specifically, a square-shaped baffle plate **26**. The preferred truncation arrangement is illustrated in FIG. **8** wherein the four-edged corner **30** has the maximum truncation along the minor axis **33** of the rhombus-shaped panels **28** which form the four-edged corner **30**. As illustrated in FIGS. **6** and **7**, a three-edged corner is truncated so that the truncated corner **18** terminates in an equilateral triangular-shaped baffle plate **24**. The degree of truncation of the truncated corner **18** is merely a matter of design preference in that the more truncation provided, the larger the dimensions of baffle plate **20**. The larger the dimensions of baffle plate **20**, the greater the diameter of the mounted speaker unit **16** attached thereto can have. Generally, for the purposes of illustration, a central axis is defined to extend from the outermost point of one corner **17** to the outermost point of an oppositely disposed corner **17**, as illustrated in FIG. **1**. In a rhombic dodecahedron, for every three-edged corner **32** or four-edged corner **30**, there is an oppositely disposed three-edged corner **32** and four-edged corner **30** respectively. As is common with all of the truncated corner embodiments of the present invention, the baffle plate **20** is substantially perpendicular to the center axis formed between the truncated corner **18** and the oppositely disposed corner **17**.

As previously mentioned, the degree of truncation of the truncated corner **18** is a matter of design preference. If the truncated corner **18** is a three-edged corner **32**, then the truncation can occur at the major axis **34** of the rhombus-shaped panel **28** or at any point further along the panel **28** relative to its major axis. Ideally, the degree of truncation will depend upon the size of speaker one wishes to mount in the resonating chamber **14**. As illustrated in FIG. **6**, if the truncation occurs past the major axis 34 of the rhombus-shaped panel 28, the resulting resonating chamber comprises nine rhombus-shaped panels 28, three gem-shaped panels 35, and a single triangular shaped baffle plate 24, the triangular-shaped baffle plate 24 being congruent to the sides of three gem-shaped panels 35. As illustrated in FIG. 7, if the truncation of the three-edged corner 32 is increases so as to truncate the rhombus-shaped panel 28 at their major axis, the resonating chamber 14 will comprise three half-rhombus portions 29, nine rhombus-shaped panels 28, and one equilateral triangular-shaped baffle plate 24, such equilateral triangular-shaped baffle plate 24 being congruent to the three half rhombus portions 29. If there is a truncation of a four-edged corner 30, the same flexibility in the degree of truncation applies as with the three-edged corner 32. More specifically, the maximum amount of truncation can be the termination of the rhombus-shaped panels 28 at their minor axis 33, as shown in FIG. 8. Also, any truncation less than that, at a position outward from the minor axis, is within the scope of the present invention. If the truncation occurs at the minor axis 33, the resonating chamber 14 comprises four half rhombus portions 31, eight rhombus-shaped panels 28, and one square-shaped baffle plate 26, such baffle plate 26 being congruent to the four half rhombus portions 31. As shown in FIG. 5, if the truncation is less than along the minor axis 33, the resonating chamber 14 comprises four gem-shaped panels 38, eight rhombus-shaped panels 28, and one square-shaped baffle plate 26 congruent with the four gem-shaped panels 38.

Additionally, openings 21 for mounting speaker units 16 may be provided on one or more opposing rhombus-shaped panels 28, as shown by FIG. 9. Although one speaker unit 16 mounted in one rhombus-shaped panel 28 is considered within the scope of this invention, better sound reproduction has been accomplished by mounting at least one pair of the speaker units 16 in a pair of the openings 16 on opposed rhombus-shaped panels 28, as illustrated in FIG. 9.

The basic rhombic dodecahedron configuration illustrated in FIG. 1 and the resulting acoustic resonating chamber 14 may also be altered without loss of acoustic effectiveness by the elongation and/or shortening of one or more zones, as illustrated in FIGS. 10 and 11. A zone of a polyhedron is a band of parallel edges. One such zone is illustrated in FIGS. 9, 10 and 11 by six parallel edges 40. Thus a rhombic dodecahedron has four bands of six parallel edges each, for a total of 24 edges. A property of a zone is that it can be elongated or shortened without any changes in the angles of the configuration or in the lengths of the edges of other zones. Therefore, a rhombic dodecahedron may be so changed that it can no longer be termed a rhombic dodecahedron but rather something like a rhombo-parallelogramo-dodecahedron; but, since there is no change in the essential angles, there is no loss of the acoustic advantages inherent in a structure having those angles.

Referring to FIG. 10, there is illustrated a variation to the configuration of the resonating chamber 14 as illustrated in FIG. 1. As previously explained, one of the zones, defined by parallel edges 40, is elongated with respect to the same zone in FIG. 1. Hence, the rhombus-shaped panels 28 of FIG. 1, which adjoin the parallel edges 40, became elongated parallelogram panels 42 in FIG. 10. In this embodiment, the parallelogram-shaped panels 27 include at least six elongated parallelogram panels 42, assuming that none of the panels 42 are truncated to mount a speaker unit 16. Referring to FIG. 11, one of the zones, defined by parallel edges 40, is shortened with respect to the same zone in FIG. 1. Hence, the rhombus-shaped panels 28 of FIG. 1, which adjoin the parallel edges 40, become shortened parallelogram panels 44. In this embodiment, the parallelogram shaped panels 27 include at least six shortened parallelogram panels 44, assuming that none of the panels 44 are truncated to mount a speaker unit 16. It is clear that the rhombus-shaped panels 28 are just a special geometric arrangement wherein the zone is selected so that the parallel edges 40 are equal in length to all other edges of a given rhombus-shaped panel 28. Clearly, the rhombus-shaped panel 28 is a special case parallelogram, and will be referred to as such in the claims so that the claims will include a resonating chamber 14 with one or more elongated and/or shortened zones. Although not illustrated for the purposes of clarity, the speaker mountings in the configuration modifications of FIGS. 10 and 11 are the same as those already disclosed. More specifically, as illustrated in FIGS. 5 through 8, the four edged corners 30 and the three edge corners 32 can be truncated to define a truncated corner 18 for mounting the baffle plate 20, such baffle plate 20 having the opening 21 for the speaker unit 16. Alternatively, as illustrated in FIG. 9, the speaker unit 16 can be mounted in any of the panels of the resonating chamber 14, whether the panel be a rhombus-shaped panel 28, an elongated parallelogram panel 42 or a shortened parallelogram panel 44. Preferably, as previously explained, a pair of speaker units 16 should be mounted in oppositely disposed rhombus-shaped panels 28, oppositely disposed elongated parallelogram panels 42, or oppositely disposed shortened parallelogram panels 44. Since it is preferable to make the plane of baffle plate 20 perpendicular to a line between opposed corners 17, the baffle plate may have a four sided configuration other than square configuration in the case of the truncation of a four-edged corner 30 and may have a three sided configuration other than an equilateral triangle configuration in the case of the truncation of a three-edged corner 32. It should be appreciated that various possible combinations of shortened zones and elongated zones are possible in that there are four zones, all of which can have bands of parallel edges 40 with different band lengths. As previously explained, the angles remain constant no matter what the zone lengths.

The rhombic dodecahedron configuration and its derivative configurations made by the elongating and/or shortening of zones, were found to have definite acoustic advantages over other geometric shapes used in the prior art. The volume of air contained within the confines of these particular configurations, when energized by the audio frequencies imparted by the speaker cone, resonates in a way peculiar to this specific combination of angles of 70 degrees and 110 degrees defining the rhombi and/or parallelograms, and their dihedral angles of 120 degrees.

The surface area-to-volume ratio of the rhombic dodecahedron is known to be the smallest of any familiar polyhedron, which we find exemplified by the bee's cell. D'Arcy Thompson in his book *On Growth and Form* (Cambridge University Press, London, 1961, Page 120) says of the rhombic dodecahedron: ". . . that of the ordinary space-filling solids with all sides plane and similar, this one has the least surface for its solid content." That this peculiarity of the shape imparts acoustic advantages to an enclosed volume of air was not realized or appreciated until discovered and utilized in the present invention.

It has also been discovered that the acoustic advantages carry over into the shapes derived from the rhombic dodecahedron made by elongating and/or shortening any zone or zones, which as previously described do not change any of the angles of the rhombic dodecahedron configuration.

It should be noted that the use of other geometric solids in the prior art failed to improve the acoustics to any significant extent, but were merely decorative or served as a means of aiming a multiplicity of speakers in various directions. Constructed of heavy, rigid materials such as veneered chipboard and using sound-deadening padding, they are in no way similar to the present invention either in their intent or in their construction.

As previously noted, the backwave energy is to a large extent utilized in this invention to cause vibration of the surface of the enclosure. Therefore the choice of materials used in the construction of this invention is determined by the same considerations as determine those of a musical instrument, such as a cello or a guitar. Light, unpadded resilient materials capable of functioning as a sounding board such as light plywood, plastic laminate, sheet aluminum, etc., are the preferred materials in contrast with the heavy rigid materials and padding of the prior art.

Referring to the previously mentioned improvement in "presence" resulting from the present invention, the improvement lies in the shape of the external wave front reaching the ears of the listener. The second produced by this invention comes not only from the speaker cone or cones of the speaker unit **16** but also from the relatively large area of the rhombus-shaped panels vibrating in response to energy released by the backwave in a manner similar to a sounding-board. As previously explained when the sound is recorded and then reproduced in a prior art box-like speaker enclosure the "presence" is lost and the listener is well aware of the sound being beamed at him from a small source.

When two of the cabinet enclosures **12** are used as a widely separated stereo pair, the improvement in presence is outstanding and far beyond anything found in the prior art devices. This may be explained by the fact that the cabinet enclosures **12** produce omnidirectional sound radiation from a large surface area while the prior art boxes radiate from the speaker cones in a beaming pattern, as previously described. The almost spherical radiation of sound from the entire surface of the cabinet enclosures **12** eliminates the previously described "hole" between sources which, as previously discussed, so plagues the prior art. With the cabinet enclosure of the present invention sound can be characterized as emanating in substantially spherical shaped waves as opposed to the cone shaped waves of the prior art boxes. Speaker placement and acoustic environment cease to be critical factors, unlike the prior art, and stereo image is greatly improved. This is an advantage inherent in the shape of the enclosure **12** and is not mere design preference.

Although particular embodiments of the invention have been shown and described in full here, there is no intention to thereby limit the invention to the details of such embodiments. On the contrary, the intention is to cover all modifications, alternatives, embodiments, usages and equivalents of the subject invention as fall within the spirit and scope of the invention, specification and the appended claims.